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JAMES P. PORTER, *Editor*
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ROBERT L. THORNDIKE. Two Screened Tests of Verbal Intelligence

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Athens, Ohio

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SEX DIFFERENCES IN THE UNDERSTANDING OF MECHANICAL PROBLEMS

GEORGE K. BENNETT AND RUTH M. CRUIKSHANK
The Psychological Corporation, New York, New York

SURVEYS of the numerous psychological research studies on the topic of sex differences have shown that, for the most part, only small differences in ability have been revealed.[1] Girls, for example, appear to be slightly superior in linguistic abilities and boys to have a greater facility with mathematical material. In tests of memory and retention, women are again slightly better. Tests of manual performance show slight superiority for women, if dexterity is involved, and for men, if strength is needed.

It is in the field of mechanical ability where sex differences have been more apparent. In tests of mechanical assembling, men are clearly superior (Paterson *et al.*, 1930). In tests involving perception of spatial relations such as the Minnesota Paper Form Board or the Minnesota Spatial Relations Test, the superiority of the men is not so marked. In tests measuring the understanding of more complicated mechanical and physical principles, the evidence obtained by Cox (1928) seems to point to the superiority of boys. Boys scored higher in the Test of Mechanical Models but were not quite as good as the girls on the Test of Mechanical Explanation. Unfortunately the groups were small and not well-matched in age or intelligence. Hence it is not clear whether these results are typical.

The present paper reports further examination of sex differences in performance on a test of mechanical comprehen-

[1] See, for example, the summaries of Anastasi (1937), Freeman (1934), and Miles (1935).

sion. This test, developed by one of the authors, consists of sixty pictorially presented mechanical problems (Bennett, 1941). The correct answer to the questions requires some understanding of mechanical operations and the application of known principles to new situations. The situations illustrated in these problems are, on the whole, ones which might be expected to be reasonably familiar to the average high school boy or girl in the United States.

The Test of Mechanical Comprehension, Form AA, was standardized on 1,900 male high school students, 600 engineering school freshmen, and 3,500 candidates for various technical courses and positions. Early in its administration it was found that the test scores for women were consistently lower than those for men. The present study was made to ascertain wherein the difference lay.

The data for the study were derived from the administration

TABLE 1

Comparison of Boys' and Girls' Scores on a Test of Mechanical Comprehension

Grade completed	N	Mean score	S.D. dist.	CR.	r_{bis}
Tenth					
Girls	98	21.90	8.83	8.27	.80
Boys	93	37.29	9.94		
Eleventh					
Girls	83	22.68	7.40	9.74	.80
Boys	67	37.51	10.47		
Twelfth					
Girls	67	24.79	9.06	9.65	.80
Boys	65	40.25	9.35		
Thirteenth					
Girls	53	27.57	8.83	10.5	.89
Boys	54	43.78	7.70		
Applicants for					
Nursing schools	89	23.37	9.10	7.2	.70
Positions of firemen and policemen	59	36.78	11.49		

of the test to 390 girls and 338 boys of comparable age and education.

Table 1 summarizes the data for these several grade groups. It will be noted that the mean scores for the boys are much higher than for the girls. The scores of the nursing applicants are lower than those of a group of applicants for positions of firemen and policemen. Age, education, and reported training in physics were not appreciably different for these latter groups. Biserial coefficients of correlation between sex and scores are given in the last column.

The data are such that there can be no question about the superiority of the average boy over the average girl in solving problems of this sort. To obtain a more detailed picture of this superiority, the items of the test were separately analyzed for the several groups and the percentage of the group succeeding in each item was determined.

When all the girls were compared with all the boys, no item was found easier for the girls. Even in the separate school-grade groups there were only fourteen instances out of a possible two hundred forty where the percentage of girls passing equalled or excelled the percentage of boys. However, for the

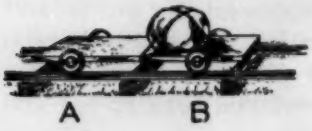
TABLE 2

Items Showing the Smallest Differences between the Percentage of Boys and Girls Successfully Answering Each One

Item	Per cent girls succeeding	Per cent boys succeeding	C.R.
4. Pressure on wheels of cart	93.4	95.0	0.9
10. Light and heavy objects in water	91.1	95.0	2.0
28. Relative conductivity of heat in wood and alumnium	83.4	87.1	1.3
37. Wattage of electric bulbs	46.7	49.8	0.8
48. Current in an electric circuit	68.7	69.5	0.22
50. Relative buoyancy of fresh and salt water	37.5	42.3	1.25

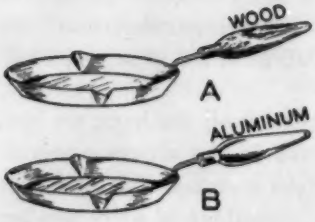
entire group there were several items in which sex differences were small.

Thirteen items show a critical ratio of three or less, of which the lowest six (critical ratios less than 2) are listed in Table 2.[2]



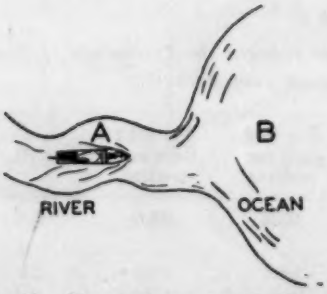
4

Which wheel presses harder against the rail?



28

Which frying pan will be easier to handle?



50

At which point will the boat be lower in the water?

FIG. 1. Items of comparable difficulty for boys and girls. (See Table 2.)

Items typical of this group are reproduced in Figure 1.

Table 3 lists six items which were among the most difficult

[2] The remaining items of the thirteen are those numbered 5, 7, 29, 34, 43, 44, and 45.

TABLE 3

Items Showing Large Differences between the Percentage of Boys and Girls Successfully Answering Each One

Item	Per cent girls succeeding	Per cent boys succeeding	C.R.
14. Efficiency of tackles	53.6	86.7	10.9
21. Direction of movement of bevel gears	45.4	90.3	14.6
22. Function of rudder in steering boat	45.9	87.1	12.6
32. Course of object dropped from moving airplane	32.3	79.9	11.0
42. Outward thrust on rails at a curve with the passage of a train	51.0	83.9	9.8
52. Volume of cylinder and cube	45.4	78.9	9.5

ones for the girls in comparison with the boys. Figure 2 illustrates several of these. All the remaining items of the test show a reliable difference between the number of boys and girls passing.

DISCUSSION

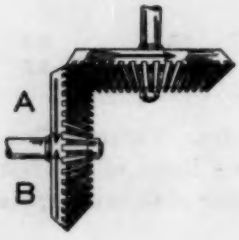
The results presented give additional support to the findings of previous investigations with regard to sex differences in mechanical ability. The differences in favor of the boys are perhaps larger than might have been anticipated in view of the nature of the content, since some of the situations represented in the test are reasonably familiar to girls and women.

It would be hasty to conclude that the basic aptitude of women for work of this sort is clearly inferior to that of men. In 1930 when the investigators of the Minnesota Mechanical Ability Project speculated upon the reasons for the differences between the performances of the sexes, they pointed out the well-known fact that greater social pressure is exerted upon boys to make use of mechanical devices, and they suggest that "fundamentally women are not inferior to men in mechanical

ability but are merely inferior in mechanical skill based upon experience and life-long opportunity to manipulate tools and mechanisms." (Paterson *et al.*, 1930.)

14

Which man has to pull harder?



21

If the upper wheel moves in the direction shown, in which direction does the other one move?

42

If the track is exactly level, on which rail does more pressure come?

FIG. 2. Items relatively more difficult for girls. (See Table 3.)

A general deficiency in the understanding of mechanical principles on the part of either men or women is relatively unimportant in an unmechanized civilization, but it becomes increasingly significant as machines are more often used.

Actually most mechanical equipment used by women either in the home or in industry has been so carefully designed that the operator needs only to know the function of the various controls for successful routine use. There are, however, potentially dangerous devices such as automobiles and hospital equipment that require more knowledge for safe operation.

The authors venture to predict that educational, cultural, and war-time economy needs will result in the recognition of the necessity for still greater mechanical training for women, so that such marked discrepancies between the performances of men and women will be considerably diminished.

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TWO SCREENING TESTS OF VERBAL INTELLIGENCE

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THERE are some testing enterprises for which a very brief "screening" test of intelligence is needed. One such situation was encountered recently when Dr. George Gallup of the American Institute of Public Opinion agreed to include a short intelligence test in one of his surveys of the American voting public. The purpose of this testing, which will be reported in the near future, was to get data on the intellectual level of a cross-section of the adult voting public.

In preparation for this testing survey, two types of test materials were assembled and standardized. One consisted of multiple-choice vocabulary items from the I. E. R. Intelligence Scale CAVD; the other of selections from the vocabulary test of Form L of the Revised Stanford Binet. In the survey, only the first of these was finally used. However, both are reported here in the thought that they may be of value to other workers.

Since one requirement of the test was that it be very brief, taking no more than ten minutes or so, it hardly seemed worth while to include more than one type of testing material. The necessity of extra instructions for more than one type of item, possible confusion in shifting from one task to another, and the extremely limited sampling of each type of item that could have been included seemed to outweigh the advantage of testing a greater variety of performances. A vocabulary test was chosen because it has been widely recommended as one of the very best test forms (as by Terman and by Wechsler), and because it seemed particularly fair and appropriate for the adult

groups for whom this material was designed. Vocabulary has generally been found to show little drop with increasing age af' · maturity. Using a vocabulary test for adults may be criticized as loading the dice in favor of the older groups, but, on the other hand, it can quite reasonably be maintained that adults *should* be tested with material which is familiar to them and is a part of their day to day experience.

THE MULTIPLE CHOICE VOCABULARY TEST

This test was composed of words chosen from the vocabulary section of the I. E. R. Intelligence Scale, CAVD.[1] A twenty-word test was prepared, containing two words from each of the levels of CAVD from H through Q. Parallel forms of the test were developed and were used in the adult survey described above. These were given in every case as an untimed power test. The words used in the two forms are listed below. The multiple-choice alternatives are not given but may be found by referring to the original CAVD blanks.

Form A		*Form B*	
space	allusion	nation	avarice
lift	caprice	every	dynasty
concern	animosity	blond	sexton
broaden	emanate	advertise	conflagration
blunt	madrigal	bog	reciprocal
accustom	cloistered	aged	broach
chirrup	encomium	conspire	largess
edible	pristine	concur	monomania
pact	tactility	downcast	umbel
solicitor	sedulous	average	sequestrate

The twenty-word test was standardized by administering both forms of the vocabulary test together with a standardized intelligence test to school and college groups. The vocabulary test was administered together with the Otis Self-Administering Intelligence Examination, Intermediate Level, Form A. to 538 pupils in grades 7, 8, and 9, together with the Otis Self-Administering, Higher Level, Form A, to 456 pupils in grades

[1] The courtesy of the Institute of Educational Research in permitting the items to be used, and the cooperation of Dr. Ella Woodyard in suggesting appropriate levels and items is gratefully acknowledged.

10 and 11, and together with the American Council Psychological Examination to 268 entering college freshmen.[2]

Otis mental age equivalents for the vocabulary tests were determined by two procedures.

(1) In each grade group, the percentile corresponding to each vocabulary score was computed, and the mental age corresponding to this percentile was determined.[3] The conversions for the several grades were combined into a composite estimate of the mental age equivalents.

(2) The average Otis M.A. and average vocabulary score were computed for each class group ranging from a very slow seventh grade to an eleventh grade honors group. These averages were plotted on graph paper, and a curve was fitted to them by eye, giving the mental age corresponding to different vocabulary scores.

The final table of Otis M.A. equivalents was obtained by averaging the values obtained by these two methods. Values yielded by the two methods agreed well except at the extremes of the range of the groups used for establishing the conversion.

The Otis Mental Age equivalents for scores on the two forms of the vocabulary test are presented in Table 1 below. The table, it will be seen, covers only the middle range of vocabulary scores. This conversion population did not have sufficient spread to enable us to determine conversions for the extreme scores, especially the higher ones. It will also be noticed that the two forms of the vocabulary test are not strictly comparable. Form B is harder at the lower levels and easier at the higher levels than Form A.

[2] Testees were obtained from the public schools of Middletown, Conn., and Rutherford, N. J., and also from Queens College in New York City. The help which was received from administrators and instructors at those places was deeply appreciated.

[3] Due to the rather low reliability of the vocabulary test for a single grade group, regressed scores were used for this process. The distribution of raw scores for each grade was converted into a distribution of estimated true scores, and the correspondence of vocabulary scores and mental ages was determined from these regressed scores.

TABLE 1

Otis Mental Age Equivalents of Vocabulary Scores

Vocab. score	M.A. equiv. Form A	M.A. equiv. Form B
13	17–6	17–0
12	17–2	16–6
11	16–8	15–11
10	16–1	15–4
9	15–2	14–7
8	13–8	13–10
7	12–0	13–0
6	10–5	12–3
5	.....	10–11

Our data also make it possible to translate vocabulary scores into college freshman percentiles on the American Council Psychological Examination. These conversions, obtained by the first procedure outlined above, are presented in Table 2 below. The conversions are based upon the verbal part of the American Council test, since the function measured by this part seemed to correspond most closely with the vocabulary test used here.

TABLE 2

A.C.E. College Freshman Percentile Corresponding to Vocabulary Scores

Vocabulary score	Percentile Form A	Equivalent Form B
17	99	98
16	96	92
15	86	79
14	73	54
13	56	32
12	42	10
11	21	—

On the basis of the correlation between the two test forms within grade groups and of the standard deviations for single grade groups and for the adult population tested, the relia-

bility of the test was estimated for a cross-section adult group. It is estimated that for such a group the correlations between two forms of the test would be .83, and the correlation of the test with a perfect criterion would be .90. These figures are based upon a population with a standard deviation of approximately 3.9 for Form A and 4.1 for Form B. The reliability in a single grade group is, of course, considerably lower.

ABBREVIATED BINET VOCABULARY TEST

Although these test materials were not used in actual testing by the author, this screening test seemed potentially valuable, and the standardization of several brief vocabulary tests using certain fractions of the word list from Form L of the Revised Stanford-Binet is described herewith.

The procedure of standardization in this case was to analyze about 1200 Binet test blanks.[4] These tests had been administered by students in a course in mental testing as part of their field work, and had subsequently been checked over with the student by the course assistant. The fact that these data arise from student testing means that certain tests were probably inaccurately given, but there does not seem to be any reason why the inexperience of the testers should introduce any constant errors into the relationship between vocabulary score and total M.A.

From each Binet test blank the C.A. and M.A. were first copied off. Then the record of the vocabulary test was examined, and vocabulary scores were determined for certain combinations of words. The following vocabulary scores were determined.

(1) Score on all 45 words.
(2) Score for 23 words—every other word, starting with the first.

[4] The test blanks were made available through the courtesy of Dr. Rudolf Pintner. Without his cooperation in supplying them, this part of the study would not have been possible.

TABLE 3

Mental Age Equivalents of Full and Abbreviated Binet Vocabulary Test Scores

Score	Test 1 45 words	Test 2 23 words	Test 3 15 words	Test 4 30 words	Test 5 15 words
1	4.4	4.8	4.8	5.3	5.3
2	4.8	5.8	6.3	6.2	7.3
3	5.3	6.9	8.2	7.1	9.4
4	5.8	8.2	10.3	8.2	11.2
5	6.3	9.7	11.9	9.3	12.2
6	6.9	11.0	13.2	10.2	13.2
7	7.5	11.9	14.5	11.0	14.5
8	8.2	12.7	16.2	11.6	14.9
9	9.0	13.6	18.0	12.1	17.2
10	9.7	14.5	19.4	12.6	18.7
11	10.3	15.6	20.5	13.0	20.0
12	11.0	16.8	21.6	13.4	21.0
13	11.5	18.0		13.9	
14	11.9	19.0		14.5	
15	12.3	19.8		15.1	
16	12.7	20.5		15.7	
17	13.2	21.2		16.3	
18	13.6			17.0	
19	14.1			17.6	
20	14.5			18.2	
21	15.0			18.9	
22	15.6			19.6	
23	16.2			20.3	
24	16.8			21.0	
25	17.4			21.7	
26	18.0				
27	18.5				
28	19.0				
29	19.4				
30	19.8				
31	20.2				
32	20.5				
33	20.8				
34	21.2				

(3) Score for 15 words—every third word, starting with the first.
(4) Score for 30 words—words numbered 2, 4, 6, 8, 10, 12, 13 to 30, 32, 34, 36, 39, 42, 45.
(5) Score for 15 words—words numbered 2, 6, 10, 13, 15, 17, 19, 21, 23, 25, 27, 30, 33, 37, 42.

Tests 4 and 5 were prepared with the thought of making a test which would be more discriminating, per minute of time, in the middle M.A. ranges where the test would be most likely to be used. These tests provide a better discrimination, per minute of working time, in the Mental Age range from about 10 years to 20 years.

The Mental Age distribution, and distribution of scores on each one of the vocabulary tests was obtained for our population. The percentile corresponding to each vocabulary score was computed, and the M.A. was found which corresponded to that percentile in the Mental Age distribution. This constituted the Mental Age equivalent of the score.[5] The table of Mental Age equivalents of scores on each of the five tests is presented below.

The reader will notice, upon examining Table 3, that M.A. equivalents are only given for a part of the range of vocabulary scores, omitting the highest scores on each test. This is due to the fact that the vocabulary test has more "top" than the rest of the Binet (an individual requires a score of only 30 on the vocabulary test to pass it at the highest adult level), and so there are no available M.A. equivalents for the highest vocabulary scores. Equivalents could, of course, be very roughly approximated by extrapolation.

The population upon which these Binet conversions were made had an extremely wide scatter of mental ages, containing as it did both pre-school children and college students.

[5] The population here studied had such a range that the score on even the briefest vocabulary tests had high reliability coefficients (about .90 for the 15-word test), so no correction in spread of scores was made to allow for test unreliability.

The standard deviation of mental ages in the group is approximately 4.2 years. For this very heterogeneous group, the reliability of the 15-word test is estimated as about .90 and that of the longer tests as correspondingly higher. This group is probably more heterogeneous than the adult group tested with CAVD materials, but no definite evidence is available on that point. Consequently, no direct comparison of the reliability of the two types of test is possible.

CODE NUMBERS AS A MEANS OF SCORING GROUP-ADMINISTERED PERFORMANCE TEST PRODUCTS

HERBERT A. TOOPS
Ohio State University

ADEQUATE guidance presupposes valid tests. In many testing realms, and notably in measuring mechanical and social intelligence and even personality, it is not unlikely that performance tests, rather than paper-and-pencil tests, are the answer to our need. These, however, are slow in making their appearance.

Among the chief obstacles to the establishment of an adequate performance-test program for guidance are (1) the *extreme time cost of scoring,* individually and by skilled help, tests which are scored by allowing partial credits for less-than-perfect performances and (2) general opposition to such, occasioned not only by their cost, which normally is high, but also, and chiefly, by *the delay* between subsequent tests, administered by use of the same equipment, *occasioned by the scoring,* which introduces, in a school for example, a generous quota of scheduling and other administrative problems and so tends to make such group-testing impracticable.

Hitherto, an assembly test such as the Minnesota Assembly Test has required almost as many (trained) scorers as examinees to keep a given number, say twenty, sets of tests in more-or-less, mostly less, continuous operation throughout a testing day. The costs of such test apparatus, not to mention the difficulties of transportation and storage, usually prohibit the purchase by schools or even school systems of two or more independent sets in quantities sufficient to permit testing an entire school grade on the one set while contemporaneously

scoring the tests of the previous grade on the second.[1] The time necessitated for efficient group-test administration—not the least of which burden is the mental inertia of overburdened school officials—accordingly usually militate strongly against the utilization of any performance tests whatsoever. And obviously this is a serious handicap to progress. What can be done about it?

The alternative in the past for simplifying the scoring of partially correct performance products has been simply to score the products on an all-or-none basis, increasing, if need be, the number of the products in the hope that the crudeness-of-grouping error might be reduced thereby to a minimum. Probably no ones knows, with certainty, whether generally or under what specific conditions this is a fair exchange. The universality of partial scoring shows at least the trend of current thought about the matter. At best, such an alternative is very costly in terms of the amount of added apparatus necessary for obtaining a given reliability of the resulting test scores.

Since all mechanical performance test products have as a common feature the fact that they are space arrangements of movable sub-parts of a whole and consequently exist in only a limited number of ways or patterns of correct and partially correct products, this suggests the employment of addends[2] as a means of quick and certain identification of such performances.

[1] The employment of two boxes, each for one-half of the test, separate administrations of each box, and the employment of a multitude of scorers is only a partially satisfactory solution.

[2] Toops, Herbert A., "Questionnaire Construction and Analysis," in Baehne, G. W., *Practical Application of the Punched Card Method in Colleges and Universities.* New York: Columbia University Press, 1935, pp. 199–201.

See also Toops, Herbert A., "Code Numbers and Coding As Aids to Research," *Proceedings of the Educational Research Forum,* New York: International Business Machines Corporation, August 26–31, 1940, pp. 56–58.

The Minnesota Mechanical Assembly Test, like many others of the performance type, must be fully scored before the several sets of tests can be disassembled preparatory to employing them for a second administration. By employing the addend system, it is our hope that the examinee may be able quickly to self-score his own test performance, or at least to make such a paper record or identification of each of his correct and partially correct products *that the scoring merit of the several individual products may be ascertained therefrom subsequently, at leisure,* by clerical workers or even by electrical scoring machines.

Such an achievement, if successful, would solve also the second obstacle since, after such identification and recording for subsequent scoring, the assembled products might be at once disassembled by the examinee himself. This would place partially-correct performance tests on a self-scoring basis, the corresponding equivalent of the self-scoring methods of the paper-and-pencil tests.

The economic principles of group testing, and self-scoring in groups, thereupon prevail, namely, that a small amount of (unpaid) time on the part of each of *many unexpert* examinees, under adequate supervision, is equivalent or more than equivalent in scoring effectiveness to the much longer time required for centralized (paid-for) scoring by one or, at most *only a few, expert* persons.

AN IDEALIZED FISH-POLE ASSEMBLY

An idealized schematic application of the addend principle is shown in Figure 1. Let us assume that a fishing pole is to be assembled from three sub-parts or joints, A, B, and C, and that the ferruled joint is *square* in cross-section with the result that there are only four ways or positions (of relative revolution of parts on the common longitudinal axis) in which a next-smaller joint can be inserted into a next larger, and in addition one way of non-assemblage, or five in all per union involved.

The guides or ferrules H, I, J effectively prevent assemblage of the joints B to A, and C to B, by *reversal* of the joints. It may be seen that C may be inserted either into B, where it fits securely, or into A, where it fits very badly, the joining being obviously quite too loose for use. The latter of these two performances (in Fig. 1) arbitrarily is considered to be just as bad as not to assemble the connection (C to A) at all (therefore not to affect, or change, the otherwise total code number of the complete assemblage[3]).

Behind aperture X, located at, say, ½ inch from the tip of joint A, on the opposite wall, d_A the inside wall of side d_A, and directly opposite the aperture is a zero, the addend appropriate to "Non-assemblage of the joint, or connection, B to A, in question." This zero is visible through aperture X when no connection (of B or C) is made to joint A and the connection is left completely disassembled.

If, however, B should have been connected to A, through X there will be seen instead that addend of the left end of joint B which happens to be opposite the aperture, this in turn depending on the amount of revolution of B with respect to A. Clearly in the figure, if the ferrules H and I are in alignment, that is if sides b_A and b_B are in alignment, a 2 will be seen through aperture X. But if b_A and a_B be in alignment, then one will see instead a 1, the addend appropriate to that particular union. Similarly if b_A and c_B are in alignment one will see the addend 3; and if b_A and d_B are in alignment then instead the addend 4 of the side d_B.

If, however, C should have been joined to A, one will see through X, one of the four zeros (leftmost figures of the left end of joint C) the addends appropriate to this particular assemblage.

[3] Clearly this arbitrary restriction is unnecessary since one may provide addends, replacing the zero's of Joint C, to permit of all C–A connections being given differential code numbers as well, this adding very considerably to the number of possible code-numbers of the complete product.

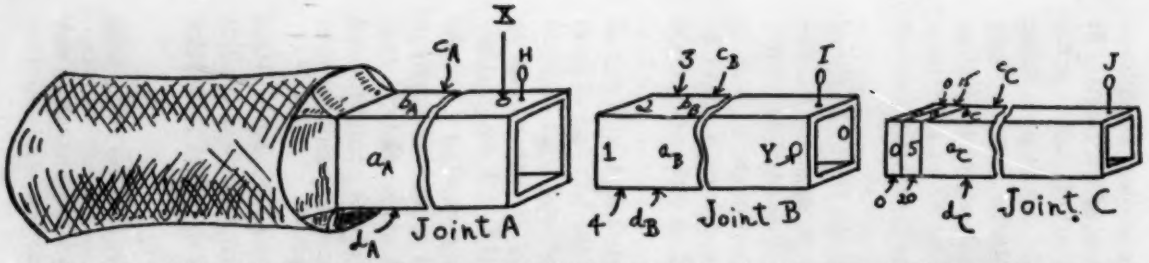

FIG. 1. A *Schematic* Representation of an Idealized Assemblage of a Product, a Fishing Rod, Amenable to the Combinations Code and Self-Determination by the Test-Taker of the Code Number of His Complete Assemblage. The following observations will make clear the system of addend coding necessitated:

1. Joint B, in respect to Joint A (that is in respect to the *connection* which is to be made between B and A), (1) may be left off A entirely, *i.e.* be left disassembled; or (2) may be inserted into A but in any one of the four possible positions with respect to a given reference point, such as the guides for the line which run throughout the lengths of the pole in common on A, B, and C.

2. Accordingly the reference point here is the connection of B to A. The scoring may then proceed on the basis of the directions, "As a starting point take up the completed product in your left hand, holding it by the handle with the B and C joints at your right and looking at the hole, "X," in joint A therein note the number seen; then look through Y and note the number seen (which of the addends 5, 10, 15, 20 of Joint C appear through the hole). Add the sum of these two numbers to obtain the code number of the entire performance." If B is inserted in A, the addends of Joint B will be seen through hole X. But if C instead is inserted in A, the leftmost addends of C, namely all zeros, will be seen through X. (If desired, these could consist of the series 25, 26, 27, 28 so to differentiate the several possible different assemblages of C inserted into A.) If C is inserted into B, the rightmost addends of C (as shown in Fig. 1) will appear through aperture Y. It will be observed that Y is placed nearer the outer end of Joint B than is X in Joint A. Opposite Aperture X is a zero on the inside wall, side d_A, which can be seen only when this union is left disassembled. Opposite Aperture Y, on side c_B of Joint B, on the inside wall is a zero which can be seen only when the connection C to B is left unassembled. For reference, the sides of the several joints are defined as a_A, the side of A nearest the observer in Fig. 1, b_A, the ferrule (or top) side of A; c_A, the side of A away from the observer in Fig. 1; and d_A, the side of A opposite the ferrule (underneath, opposite side b_A, in Fig. 1). The four corresponding sides of B are referred to as a_B (nearest the observer in Fig. 1), b_B (ferrule side), c_B and d_B (bottom side in Fig. 1). The end of any next smaller joint may be inserted into the socket of a larger joint for $\frac{1}{4}$-inch only.

Behind aperture Y, located at, say, ¼ inch (*half* the distance of X from the end of A) from the tip of joint B, on the opposite wall on the inside of side c_B, and directly opposite the aperture is a zero, the corresponding addend appropriate to "non-assemblage of the joint, or connection, C to B, in question."

If C should have been joined to B, with sides b_B and b_C in alignment, then one will see through Y a 5, the addend appropriate to that union; and if a_B and d_C be in line, then one will see instead a 20, which is the appropriate addend contribution of that type of a C–B union to the code number of the entire assemblage. None of the letter-labels of Fig. 1, save possibly X and Y, the labels of the apertures, are placed on the three joints.

In summary then, this arrangement permits, it will be seen, the following:

1. Viewing through X, when B is inserted into A, the addend of joint B, appropriate to whichever of the four sides of B may be placed in alignment with side b_A (containing the aperture X).

2. Viewing through X, when C is inserted into A, that one of the *left-hand* set of addends of C appropriate to the particular joining of C to A, here all being taken *arbitrarily* to be zero, this assuming that such a poor performance is no better than to leave the parts A and C lying disassembled on the table.[4]

3. Viewing through Y, when C is inserted into B, that one of the *right-hand* set of addends of C appropriate to the particular joining of C to B, the one seen obviously depending upon which of the sides a_C, b_C, c_C, d_C, is placed in alignment with a_B (containing the aperture Y).

4. Adding the two aperture-contained (X and Y) addends, in order to obtain the code number of the complete assemblage.

[4] The addends appropriate for replacing the zeros of C, if desired are 25, 26, 27 and 28, such scoring giving rise to 29 ways in all that the rod can be assembled.

By the way of further effort to make clear to examinees that the magnitudes of the addends are not in any way associated with the merit of the performance, the addends of a given joint may be applied to the several sides in random order, particular care being taken to insure that a perfect performance does not get the highest possible code number. Twenty-four orders of the addends with respect to the four surfaces are possible, thus making it possible to have twenty-four forms of the test, each to be scored with a different stencil, with no two exactly identical, for the prevention of cheating.

Clearly, then, the total performance on this pole is a case of a *combinations code*[5] and the several connections of C to B accordingly may receive the addends respectively $a_C = 5$, $b_C = 10$, $c_C = 15$, $d_C = 20$ (or, preferably, as above indicated, these may better be ascribed in random order).

It is clear that the apertures X and Y do not have to occur (and, preferably, should not occur) on the same side of the two Joints A and B respectively. They should be so placed as to give the examinee no aid in assembling his product, and so presumably should preferably not both be placed on the same sides of the two joints in which they occur. (And they may differ in the 24 several different "forms" of the test.)

It is clear that there are twenty-five ways in which the fishing pole may be assembled, ranging from 0, completely disassembled, to 24, only one of which, 7 (the imminent asssemblage of the figure) is a perfect assemblage. It should be remembered that if the addends of a given joint are applied at random[6] to the sides of that joint the *magnitudes* of the code

[5] Toops, *op. cit.*

[6] Clearly the addends 1, 2, 3, 4 of the following footnote may be assigned at random to the addend-positions a_B, b_B, c_B, d_B, and the addends 5, 10, 15, and 20, may be assigned at random to the addend-positions a_C, b_C, c_C, d_C, the whole system thus yielding twenty-five combinations, since the addends of the first row are to be associated in all of the possible combinations (two at a time) with the addends of the second. The representation of the addend system herein assumed, in the familiar test-taking form, is:

numbers of the total assemblage are not proportional, in any ascertainable way, to the merit of the several twenty-five assemblages. The examinee need record (correctly) only the code number of the complete assembly to fully identify his product. From this code number obviously anyone may readily re-establish exactly the original performance. The code number is an appropriate abbreviation for such clumsy verbal records as "Joint C inserted into Joint B with b_B and c_C in alignment, and Joint B inserted into Joint A with b_B and b_A in alignment."

The paper record of many hours of industrious work can be recorded for many such sub-tests in a very small amount of space when such verbal reports become code numbers.

When scoring the record, the merit of any one completed assemblage is to be ascertained independently, by referring the code number to a scoring book, or equivalent, or be determined by alternative means such as by the aid of a scoring stencil, or an electrical scoring machine scoring of the paper record. The score of total merit of an assemblage may have been originally obtained by a process of weighting sub-portions of the total assembly; but any such weighting needs to be done only once for all the possible total patterns of assemblage (29 in the case of the fish pole and 9 in the case of the bolt below).

The scores, for the scoring book, or stencil, appropriate to the twenty-nine several possible assemblages, may be ascertained by such expedients as the following:

1. A least squares method: By finding the mean criterion score of all those persons receiving each code number, *i.e.*, total assemblage pattern, and giving credits to the several patterns proportional respectively to these averages or some function of them.

2. Or, arbitrarily: By assigning a credit to each code num-

Side of B associated with hole X in A is: $1a_B$, $2b_B$, $3c_B$, $4d_B$, 0 assembly B–A entirely omitted.

Side of C associated with hole Y in B is: $5a_C$, $10b_C$, $15c_C$, $20d_C$, 0 assembly C–B entirely omitted.

ber, or pattern of total assemblage, on its "judged excellence of merit."

3. Or by employing a finer subdivision of the total assemblage into sub-parts each of which is weighted by either method (1) or method (2).

It will be clear that not the least of the gains to be secured from the addend system is the gain in objectivity of scoring. The possible errors of recording the patterns of a product so ideally applicable to the addend system of coding are almost solely those of incorrect addition of the addends. Anyone who can read two numbers appearing in apertures and add them correctly[7] can identify instantly any one of twenty-five partial assemblages, of our illustration, which many words in a set of "Directions to Scorers" probably would fail to make clear, to which assertion any psychometrician readily can bear witness. Such errors presumably can be obviated after self-scoring by having adjoining examinees *independently* verify each other's code numbers.

Some of the simplest of test performances, when examined in the light of their solution by addends, become the most complex. The Lifted Weights Test, for example, may be seen to be a case of a *permutations* code and so to require a code of that complexity for its solution.

A BOLT-AND-WASHER ASSEMBLY

We illustrate below the scoring of a second assembly product by means of addends. In Figure 2f is shown a correctly assembled product. In Figure 2a is shown the *standard position* (2a) *for scoring*, namely upright on the table with the

[7] Errors of adding may be minimized by employing addends, based on the 10's system, the base of our number system, as follows:

Seen through X:	$1a_B$	$2b_B$	$3c_B$	$4d_B$	0
	$100a_C$	$200b_C$	$300c_C$	$400d_C$	0
Seen through Y:	$10a_C$	$20b_C$	$30c_C$	$40d_C$	0

The resulting code numbers will range between the extremes of 0 and 400 with many gaps, but with few errors in adding.

bolthead, of A, down, in which the bolt is always to be placed for this operation. For the scoring it is always necessary, for reasons made apparent below, that the final product of the examinee be placed in the standard position (2a). The space-relationships then are defined as the connections of (1) the washer, B, and (2) of the nut, C, thereunto, and may be written in multiple-choice test form as follows:

With Bolt in Standard Position (Figure 2a)

Washer B, in respect to Bolt A, is:

(0) Left off Bolt A entirely.
(1) Placed smooth side up (2b).
(2) Placed with corrugated (cross-hatched) side up (2c).

Nut C, in respect to Bolt A, is:

(0) Left off Bolt A entirely.
(3) Placed rounded side up (2d).
(6) Placed flat side up (2e).

The correct assemblage is shown at Figure 2f, where obviously to the scorer *looking down* on the bolt assemblage, the *addends 0, 1 and 3 only are visible,* to be added to make 4, the code number of the complete correct assemblage. In this product it will be noted that in addition to the possible errors of adding the addends, there are also the possible errors of placing the bolt head upwards when scoring, instead of in the correct scoring position 2a, whereupon obviously the addends 2 and 6 instead are visible from this inverted and incorrect position as one looks down on the assemblage. (However here one will see only *two* addends, and not *three.*) Like the former type of error this presumably can be detected by *independent* scoring and recording of the code number by a second examinee, particularly if shields around the desks prevent one pupil from viewing the assembling and scoring operations of another.[8] And it can be prevented also by such expedients as

[8] The author has yet to see in schools his first "testing room" fitted with test-taking arrangements equivalent to the crude appointments of the army testing buildings of the World War.

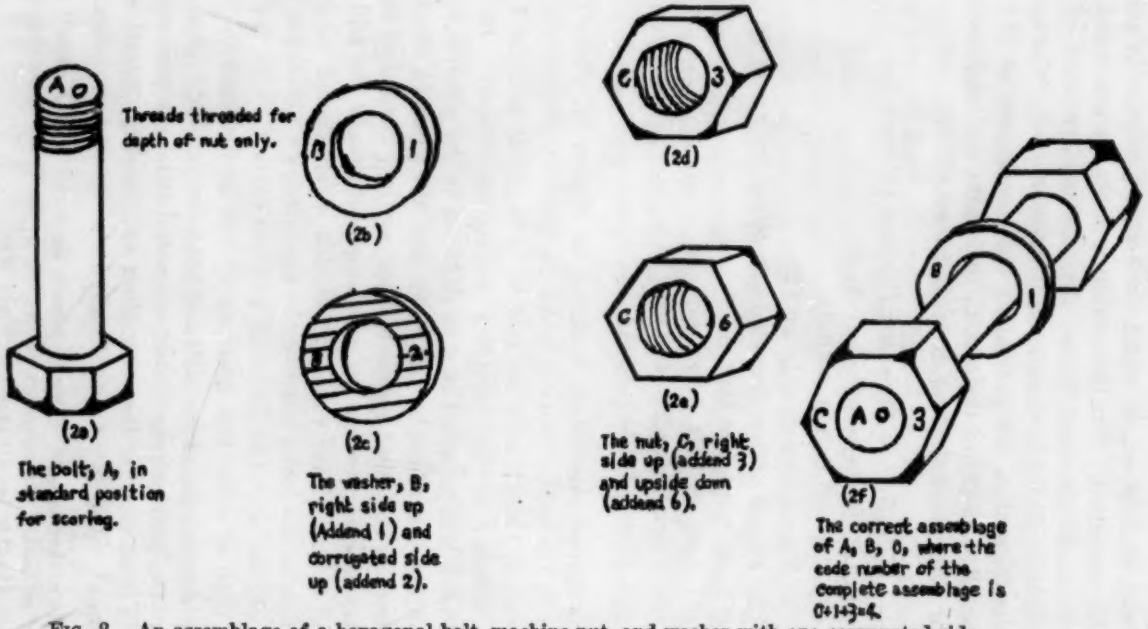
A 0
Threads threaded for depth of nut only.
(2a)
The bolt, A, in standard position for scoring.
B 1
(2b)
1 2
(2c)
The washer, B, right side up (Addend 1) and corrugated side up (addend 2).
C 3
(2d)
C 6
(2e)
The nut, C, right side up (addend 3) and upside down (addend 6).
B 1
C A 0 3
(2f)
The correct assemblage of A, B, C, where the code number of the complete assemblage is 0+1+3=4.

FIG. 2. An assemblage of a hexagonal bolt, machine nut, and washer with one corrugated side.

(1) adequate directions as in concert one-by-one scoring of the several products with special verbal directions preceding each, or (2) by placing the addend, 2000, say on the *head* of the bolt which would (presumably) be added in as a portion of the code number if the bolt were reversed for the scoring. If scorers A and B then differ in their independent coding of the same assemblage, by having code numbers 4 and 2008 for the same assemblage, then obviously one is the code number appropriate to a given assemblage in its correct scoring position, and the other (the larger) is the complementary code number, appropriate to the same assemblage when viewed in the incorrect position. Accordingly code numbers and corresponding complementary code numbers, side by side in horizontal alignment, may be the arguments for locating in the scoring book the score appropriate to a given total performance.

Clearly, one cannot claim that all performances of all assembly products can be so coded. In fact, in Figure 2 it is clear that the threads on the bolt are threaded only so far as not to allow of the washer being placed on the bolt *after* assemblage thereon of the nut. If the nut were threaded for a greater length than this, then the washer might be assembled on the bolt after the nut were screwed down fully. The possible number of scoring patterns accordingly would be much increased *and the principle of automatic coding by the examinee's simply adding the VISIBLE addends would break down completely.*

For *expert* scoring, even this latter situation, however, is easily handled in a paper-verbalized code which takes account of this relative order of nut and washer[9] as follows:

[9] Clearly, to represent completely all the *space* positions of *possible* interest of these three objects, one must use a more complicated code to take account of the washer B being left on the table, not on the bolt, and with a distinction as to which side is up; and of the nut being on the table, not on the bolt, and with a distinction as to which side is up; and a still more complicated one to take account of the additional statistical variation needed for *statistical* completeness, dealing with completely *losing* any or all of the articles A, B, C by combinations of ones, two's, and threes!

With Bolt in Standard Position (Figure 2a)

Washer B, in respect to Bolt A, is:

(0) Left off A entirely.

(1) Placed on the bolt but with the nut left off entirely.

(2) Placed on the bolt but *below the nut, i.e.,* between the nut and the head of the bolt (with the nut on the bolt).

(3) Placed on the bolt *above the nut, i.e.,* on the threaded portion of the bolt with the nut beneath the washer.

Washer B, in respect to Bolt A, is [sides of B uppermost]:

(0) *Left off A entirely.*

(0) *Placed on Bolt A with smooth side up (as in Fig. 2b).*

(4) *Placed on Bolt A but reversed (as in Fig. 2c).*

Nut C, with respect to Bolt A, is:

(0) Left off A entirely.

(8) Placed on Bolt A but with rounded side up (as in Fig. 2d).

(16) Placed on Bolt A* but with flat side up (as in Fig. 2c).

The possible number of patterns here is 24, and is found by taking 1 more than the number of the maximum addends of the three several sections of the above. The table has the disadvantage that the correct coding of the product of assemblage depends upon (1) a correct *verbalizing* of a situation and (2) selection of the appropriate addends from the above table, thus practically necessitating the employment of expert scorers. Obviously such a table with voting boxes preceding, for checking by the scorer, would be much superior to most "scoring keys" now employed by "expert" scorers.

The assemblage (Fig. 2) having been correctly coded and recorded, clearly the examinee is the logical person to do the disassembling and checking of the test kit, preliminary to a subsequent administration of the test. This can be accomplished easily by having recesses profiled into a block of wood, the container of a given article-to-be-disassembled, of the exact shape and depth of the several parts A, B, C (Fig. 2).

Such blocks of wood will replace the small compartmental containers or boxes employed for such parts in the past.

By a further step of labeling these recesses with the letters and code numbers of the several parts, where each is in its own individual fixed position (see Fig. 3), one could easily secure

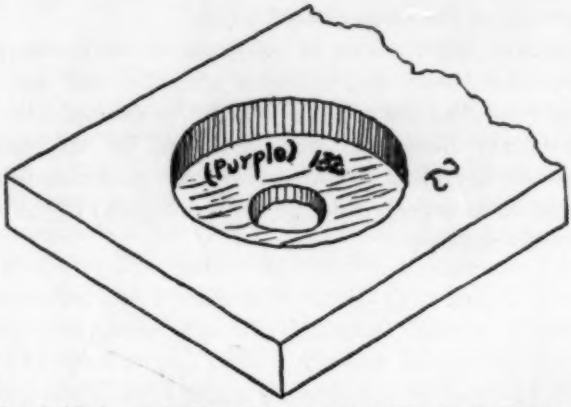

FIG. 3. A block, container of the parts of Figure 2, illustrating the recessing and numbering of Figure 2c, to facilitate correct disassembly and replacement of the parts.

Purple paint on bottom of recess, in the shape of the washer and therefore not visible when the washer is in place with either side uppermost. The hole in the bottom is larger than the washer hole to permit finger pressure to remove the washer in case of need.

If the washer (Fig. 2c) is placed into the above recess in the proper position, the 2 of the washer will check with the 2 at the right of the recess, and so serve to present the test always in a *standard order* to the examinee. Absence (loss) of the washer is quickly apparent upon a very casual inspection from the fact that the purple paint ring on the bottom of the recess is visible only when the washer is absent from its recess. If on the purple is recorded the (unique) box number (drawer number or stock number) of the supply cabinet, 132, in which the washers are kept for replacement of lost parts, replenishment will be greatly facilitated. The replenishment number also is seen only when replenishment is necessary.

the desirable end of *having the several disassembled test parts always presented to the test subject in a standard fashion.* In the lifted weights test, for example, it is clear that the weights, *by chance,* may be presented to the subject in an order which

with no, or at most only a few, orderings after being shoved into a straight line formation, may be in the correct order. And in the Minnesota Assembly Test clearly a cotter-pin lying near a hole into which it fits, with the small end of the pin directed at or even partly inserted into that hole, unduly aids, or hinders, the examinee to whom comes by chance such an arrangement of the disassembled parts.

As further applications of addends to such scoring the examiner-scorer may find addends a useful and economical means of *recording* the order in which, for example, the lifted weights of the Binet test were arranged by the examinee. Such records are ideal for later follow-up in determining the social implications (regression equation weights) of the several *patterns* of response.

REPORT ON THE ACTIVITIES OF THE PSYCHOLOGICAL CORPORATION 1941

THE twentieth year of the Psychological Corporation's history, 1941, was its most successful to date from an overall standpoint. Although losses resulted from the operation of two of its five nominally separate Divisions, there was an increase in the Corporation's total net profit over 1940 of approximately 8 per cent.[1] The titles of the Divisions now maintained are: The Marketing and Social Research Division; The Industrial and Personnel Research Division; The Clinical Division (comprising the Psychological Service Center and Child Adjustment and School Service Division); The Test Division; and The Testing Service for Schools of Nursing Division. The services of the first three Divisions are offered by both the New York and Chicago Offices of the Corporation; those of the latter two Divisions only by the New York Office.

The Annual Meeting of the Corporation on November twenty-eighth in New York was made a special event to mark the Corporation's twentieth anniversary and to honor its founder, Dr. James McKeen Cattell. A luncheon and program of panel discussions were arranged at the Hotel Roosevelt and were attended by over 300 persons. This attendance, about equally divided between business men and psychologists, signified both tribute to Dr. Cattell and the good-will for the work of psychologists which the Corporation has been instrumental in gaining. It was announced at the luncheon that, as an "award" to Dr. Cattell, the Corporation was establishing a series of grants-in-aid of research to be known as the

[1] Copies of the Corporation's Balance Sheet and Profit and Loss Statement for 1941 are available to stockholders on request to the Treasurer, 522 Fifth Avenue, New York, N. Y.

James McKeen Cattell Grants and that the first appropriation for this purpose was the sum of one thousand dollars to be distributed in four grants of $250 each. Owing to accounts of the Corporation's activities given at this meeting and already published in the *Journal of Applied Psychology,* only a brief summary of the Corporation's activities is warranted here.[2]

Within ten days of the Annual Meeting came the full involvement of this country in the second World War, foreshadowing disruptions in all normal lines of business and endeavor on the part of all business organizations to serve usefully in the war effort. It will be recalled that the services of psychologists in the previous war gave an impetus to applied psychology which accounted in part for the founding of the Corporation in 1921. Their contributions, however, were made as individuals in special services for the government and the armed forces. This highly desirable demand for psychologists was already being felt in 1941. As it increases, the problem of the Corporation will doubtless become that of so adapting its services and decreased personnel, both among staff and Research Associates, as to maintain successful operations as a business organization.

Up to the time of writing this report the following members of the New York Office force were already in, or shortly to enter, government or military service: Dr. Sydney Roslow, Henry A. Lutz, Dean Manheimer, Richard A. Fear. Dr. Wallace H. Wulfeck of the Marketing Division was released for the greater part of 1941 to work on an important research project for the armed forces. It is expected that he may be able to return to the Corporation on a part-time basis in April 1942. The Head of the Test Division, Dr. George K. Bennett, although continuing with the Corporation in this capacity, has rendered valuable service as consultant on various military personnel projects and, together with the research assistants

[2] For addresses given at the luncheon and reports of panel discussions see *Journal of Applied Psychology,* Vol. XXV, No. 6, Dec. 1941, and Vol. XXVI, No. 1, Feb. 1942.

in his Division, has contributed notably in the development of tests of mechanical comprehension and others of military usefulness.

MARKETING AND SOCIAL RESEARCH DIVISION

An important nation-wide study for the United States Treasury was conducted by this Division at the close of the year. Two surveys totaling 4,000 interviews were made for social research, experimentation and developmental purposes and were financed almost entirely from funds set aside by the Division for such use. Some of the results were published in the *Journal of Applied Psychology,* "A Study of Public Opinion and Morale," by H. C. Link, December 1941.

During the year this Division conducted a great variety of public opinion studies, taste, product, trademark confusion, advertising and readership studies. The Psychological Brand Barometers continued with 10,000 interviews every three months, and received further recognition as the oldest existing poll of public opinion and buying habits. A paper on "The Validity vs. Reliability of Public Opinion Polls," by Dr. Link with the collaboration of Dr. A. D. Freiberg reflects in some measure the scientific foundations laid by the studies of this Division in the field of social research. The paper was read at the September meeting of the American Psychological Association and is appearing in the March 1942 issue of the *Public Opinion Quarterly.*

The gross receipts of this Division were 19 per cent ahead of 1940. Both in volunteer and paid work, the cooperation of Research Associates and their assistants and students was excellent and is gratefully acknowledged. The prospects of this Division for 1942, due to war conditions and the curtailment in the appropriations of many companies for consumer research, are very uncertain. The most unusual kind of effort and vision by the staff and the continued loyalty and cooperation of its Research Associates and their field workers are necessary for even moderate success in 1942.

INDUSTRIAL AND PERSONNEL RESEARCH DIVISION

The operation of this Division again resulted in a slight financial loss for the full year. In the last quarter, however, changes in organization and services were effected which led to some improvement.

During this latter period the New York Office installed employee testing programs for two manufacturing companies, one making aircraft engines, the other in the process of conversion from making gasoline pumps to making armor-piercing projectiles. In both instances suitable arrangements were promptly made for the trial of certain available tests, especially those of mechanical comprehension, as the prime need was for immediate aid in selecting promising material for training, both among inexperienced applicants and among present employees considered for new assignments and up-grading. Preliminary findings were sufficiently favorable to warrant continued use of the tests but also indicated two needs. One, the development of several general, or basic, batteries of tests and interview methods widely applicable for rough preliminary sorting of applicants, and two, the development of more tests of the work sample and apparatus type for use in specific situations. Thus, two new manipulative tests were devised and a third re-adapted for experimental use in the company making projectiles. Similarly, in December, work was begun on the construction of a special apparatus test for power sewing machine operators for a shirt manufacturing company.

Of particular interest was an assignment from an airplane propeller company. Here the Corporation's services were retained to assist them in recruiting and selecting a considerable number of their experienced employees for maintenance and repair work under difficult conditions in Africa or other foreign countries.

The business of the Chicago Office in the industrial field also showed improvement in the last quarter. A personnel survey was begun for a candy manufacturing concern and work on selection tests for a concern making glass containers and other glass products. Services undertaken for a large electrical

equipment and engine manufacturing company led to Dr. A. K. Brintnall's acceptance of a position offered him in their personnel department. This loss to the Corporation's staff was happily offset by the company's continuing the services of the Chicago Office on a monthly fee retainer basis.

Both the New York and Chicago Offices continued their services to a number of companies in testing and interviewing men sent to them for this form of careful appraisal, counseling, and written report to the company.

At the year's end plans were under consideration as to the feasibility of the Corporation's developing certain batteries of tests which, under proper supervision by psychologists, might be useful to many companies in the present situation of increasing employment and decreasing supply of skilled labor.

As of April 1, 1941, Mr. M. B. Lynaugh left the staff of the Division to accept a position with the Western Electric Company, and Mr. Richard A. Fear became a full member of the staff. As of September 1, Dr. R. S. Schultz was granted a several months' leave of absence.

CLINICAL DIVISION

As indicated in previous reports, it is desirable to render the high standard type of professional services offered by this Division but difficult to operate them on a profitable basis. Fewer members of the staff were able to participate in the work of this Division during 1941 and corresponding decreases in overhead could not readily be made. Hence a matter for special commendation is the fact that the income for the Division from the work of its Associate Director and its only full-time consultant, Dr. Rose G. Anderson, showed an increase of 150% over 1940.

An interesting new departure in this Division was a study conducted by Dr. Rose G. Anderson for the Y.W.C.A. This involved the analysis of test results and personnel records on 258 applicants for positions in the Y.W.C.A., which were compared with test results on a sampling of present successful personnel. This study is being continued in 1942, and it is hoped that it may lead to similar work for other organizations.

The total number of persons individually counselled by the Division during 1941, exclusive of telephone and brief information services, was 160, the majority of problems falling in the field of educational and vocational guidance. In addition Dr. Anderson and Dr. Erb conducted testing programs and individual work with students at five private schools.

TEST DIVISION

The Test Division showed a substantial increase (26 per cent) of gross business over the previous year. This can be attributed in part to the normal trend in test use, but an appreciable portion appears to have been due to the educational and occupational changes consequent to the increasing war effort. The test publications of the Corporation, concentrated in the fields of intelligence and aptitude, have characteristics useful in the selection and classification of industrial and military personnel. It has been of particular gratification that the armed forces have found it advantageous to utilize the facilities of the Test Division both as a source of supply for existing forms and as a source of technical advice in the preparation of needed tests.

During 1941 the following books and new tests were published: Clinical Aspects and Interpretation of the Strong Vocational Interest Blanks, by John G. Darley; The Measurement of Intelligence of Infants and Young Children, by Psyche Cattell; A Practice Manual in Vocabulary Building, by Herbert Moore; Infant Intelligence Tests, by Psyche Cattell; Mechanical Comprehension Test, form AA, by George K. Bennett; Minnesota Personality Scale, by John G. Darley and Walter J. McNamara; The World Test, by Charlotte Buehler and Gayle Kelly; and Recreation Inquiry, by Richard Wilkinson and Sidney L. Pressey.

In preparation for publication during 1942 were Modified Alpha form 9, by F. L. Wells; Adult Personnel Test, by R. G. Anderson; Simple Posting Test, by B. Candee; Mental Examiners Handbook, by F. L. Wells and J. Ruesch; Mechanical Comprehension (higher level), by G. K. Bennett and D. E.

Fry; and a Summary of Manual and Mechanical Ability Tests, by G. K. Bennett and R. M. Cruikshank.

Although the research unit of this Division entails considerable added expense, its services are a valuable adjunct to those of the Testing Service for Schools of Nursing Division and the Industrial Division. The work of this unit also enables assistance to authors and the publication of better constructed and more thoroughly standardized tests than would otherwise be possible.

TESTING SERVICE FOR SCHOOLS OF NURSING DIVISION

The gross receipts of this Division were above those for 1940 but operating expenses also increased. During the year its services were utilized by 217 schools of nursing located in 26 different states. A total of approximately 10,050 applicants were tested. This involved the scheduling of 336 testing dates, in 41 different states, Canada, Mexico, and Puerto Rico. As in the case of the Marketing and Social Research Division, the work and cooperation of many local psychologists is needed for the effective operation of these far-flung services and is gratefully acknowledged. In 1941 the testing of over 2,600 applicants was handled by 159 local psychologists to whom payments totaled approximately $2570.00.

Research work by the Division was continued along the lines of correlation of test scores with school records (1,471 cases) and intercorrelations of tests to improve the prediction of batteries. For 436 cases test scores were also studied in relation to total grades on state licensing examinations as well as grades in individual subjects. Work was also begun on the development of a mechanical comprehension test for nurses and further analysis of data accumulated from the trial of various personality tests.

Miss Elizabeth Kemble, R.N., B.S., was added to the staff as an assistant director of the Division. Miss Helen McKey left the Division, October first, to enter the course offered by the Henry Street Nursing Service. Articles written by members of the staff and published during the year were as follows: "Study Habits Inventory Scores and Scholarship," *Journal*

of Applied Psychology, February 1941, "Psychological Tests in Guidance," *Trained Nurse and Hospital Review,* February 1941, by H. Phoebe Gordon; "The Selection of Student Nurses," *The American Journal of Nursing,* May 1941, "Use of Tests in Selecting Student Nurses Advantageous to Hospital and Student," *Hospital Management,* September 1941, "Types of Tests Valuable as Aid in Selecting Student Nurses," *Hospital Management,* October 1941, and "Formation and Maintenance of a Testing Program," *Hospital Management,* November 1941, by Edith Margaret Potts.

During the greater part of 1941 the following served as staff members and principal assistants in the Corporation's Offices: *New York:* P. S. Achilles, Ph.D.; R. G. Anderson, Ph.D.; A. D. Arnheim, A.B.; G. K. Bennett, Ph.D.; P. G. Corby, M.A.; M. B. Erb, Ph.D.; H. P. Gordon, M.A.; R. A. Fear, Ed.M.; A. D. Freiberg, Ph.D.; J. R. Hochstim, Ph.D.; E. Kemble, R.N., B.S.; H. C. Link, Ph.D.; D. Manheimer, M.A.; Helen McKey, R.N.; E. M. Potts, M.A., R.N.; R. S. Schultz, Ph.D.; F. Sutton, M.A.

Chicago: A. K. Brintnall, Ph.D.; A. W. Kornhauser, Ph.D.; R. N. McMurry, Ph.D.; Milton A. Saffir, Ph.D.

At the Annual Stockholders' Meeting in November the following were elected to the Board of Directors for a term of four years: Harry D. Kitson, Arthur W. Kornhauser, Walter R. Miles, A. T. Poffenberger, R. S. Woodworth. For a term of one year, officers and members of the Executive Committee were elected by the Board of Directors as follows: Chairman of the Board, J. McKeen Cattell; President, Walter R. Miles; 1st Vice-President and General Manager, Paul S. Achilles; 2nd Vice-President and Treasurer, Henry C. Link; Secretary, Albert D. Freiberg; Assistant Treasurer, Philip G. Corby; Assistant Secretary, George K. Bennett; Members of the Executive Committee: J. McKeen Cattell, Walter R. Miles, Walter V. Bingham, A. T. Poffenberger, R. S. Woodworth, and ex-officio, the Vice-Presidents and Secretary.

PAUL S. ACHILLES
1st Vice-Pres. and General Manager

A COMPARISON OF THE REVISED STANFORD-BINET, FORM L, WITH THE KUHLMANN TESTS OF MENTAL DEVELOPMENT. II. PERFORMANCES OF MENTALLY DEFECTIVE CHILDREN[1]

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IN a recent article (1) the writer questioned the advisability of using, interchangeably, intelligence quotients and mental ages obtained on the Kuhlmann tests of Mental Development with those on the Revised Stanford-Binet, Form L. After testing a group of 51 mentally retarded subjects with C.A.'s between 16–0 and 17–5, the writer found that the mean M.A.'s and I.Q.'s on the Revised Stanford-Binet were significantly higher than the means on the Kuhlmann Tests. On the basis of this and other data, it was concluded that, within the age ranges 16–0 and 17–5, experimenters (a) should not combine scores obtained on both tests for different mentally retarded individuals and (b) should not substitute one test for the other, assuming that either will yield the same result.

In order to determine whether previous conclusions based on chronological ages above sixteen could be applied to chronological ages below sixteen, we carried out the following experiment between September 1938 and July 1939:

From the population at the Minnesota School and Colony between the ages of 7–6 and 15–11, the writer eliminated all

[1] The writer wishes to thank Dr. E. J. Engberg, Superintendent of the Minnesota School and Colony, for permitting and encouraging this research, and Dr. Amanda Herring who aided in the administration of the Kuhlmann tests.

who had previously scored I.Q.'s under 50 on the Kuhlmann-Binet (5); who had serious speech, physical, or sensory handicaps; and who could be classified as "a clinical type" (4, p. 202). We then administered the Revised Stanford-Binet, Form L, at random to half of the remaining 154 subjects, group A.[2] When this was completed, the writer and an examiner from the State Bureau of Research administered the Kuhlmann Tests of Mental Development to the other half, group B. Following this, the Kuhlmann tests were given to group A and the Revised Stanford to group B. The difference in time between the administration of the two tests ranged from four to eight months with the mean of 5.9 for group A and 5.8 for group B.

The children who could read sentences were given the Gray Oral Reading Paragraphs Test (3) immediately after the Revised Stanford-Binet. If a child's oral reading age was eighteen or more months behind his adjusted Stanford mental age,[3] he was excluded from our study. Our final experimental group was composed of 135 subjects.

LIMITATIONS OF THE PROBLEM

From chronological age 13–2 to 16–0, Kuhlmann and Terman use different methods of computing the I.Q. Because of this, the comparison of the I.Q.'s above this age becomes a questionable procedure. Should one compare the Revised Stanford-Binet I.Q.'s obtained by use of the graduated tables (8, p. 30) with the Kuhlmann I.Q.'s obtained by using the exact C.A., in months, as a divisor; or should one rescore the Stanford I.Q.'s according to the Kuhlmann tables before making this comparison? In this paper we have, first, studied the relationship between Kuhlmann I.Q.'s (K in Table 1) and Stanford I.Q.'s (S in Table 1) computed according to each author's

[2] The Stanford was scored to failure on two successive levels and the Kuhlmann was scored to a corresponding point.

[3] To obtain this value the Revised Stanford-Binet was rescored so that the influence of the reading tests was removed.

TABLE 1

TABLE 1

Intelligence Quotient and Chronological Age Data Concerning 186 Subjects with C.A.'s from 7–6 to 17–5 at the Minnesota School and Colony

C.A. groups	No. of cases	Test*	Mean C.A.	Range of I.Q's	Mean I.Q.	Sigma I.Q's	Mean I.Q. differences	t† test	F‡ test	Pearson r S_r and K	t§ test of r
I 16–0 to 17–5	51	S	201.1	46 to 86	66.98	9.14	S – K = 6.88	7.90 P < .01	1.57 P > .05	+.74	7.88 P < .01
		S_r		43 to 80	63.20	8.42	S_r – K = 3.10	3.65 P < .01	1.31 P > .05		
		K	199.6	46 to 73	60.10	7.29					
II 14–7 to 15–11	43	S	183.4	43 to 100	61.60	13.17	S – K = 3.30	4.07 P < .01	1.81 P < .05 > .01	+.81	11.89 P < .01
		S_r		38 to 95	58.49	12.76	S_r – K = 0.19	0.17 P > .50	1.70 P < .05 > .01		
		K	183.2	37 to 78	58.30	9.78					
III 13–2 to 14–6	31	S	165.7	44 to 84	59.97	10.54	S – K = 1.29	0.95 P > .10	1.98 P < .05 > .01		
		S_r		42 to 81	58.68	10.26	S_r – K = 0.00	0.00	1.87 P < .05 > .01		
		K	165.8	42 to 72	58.68	7.49					
IV 11–7 to 13–1	30	S	146.6	38 to 76	58.83	10.77	K – S = 0.99	0.77 P > .10	1.58 P > .05	+.85	12.40 P < .01
		K	146.7	41 to 77	59.67	8.56					
V 7–6 to 11–6	31	S	118.4	46 to 90	66.61	10.36	S – K = 0.71	0.34 P > .50	1.15 P > .05		
		K	118.3	51 to 87	65.90	9.64					

* S has reference to the Revised Stanford-Binet I.Q's that have been calculated on the basis of the Terman-Merrill tables.
S_r refers to the Revised Stanford I.Q.'s that have been calculated on the basis of the Kuhlmann tables.
K refers to Kuhlmann I.Q.'s calculated by means of the Kuhlmann tables.

† Fisher t test of significance of difference between means for small samples, when variates are paired. See ref. 4, p. 42.

‡ Fisher F test of significance of difference between variances. Ref. 2, p. 60.

§ Fisher t test for the significance of the correlation coefficient. Ref. 2, p. 72.

directions. Second, we have compared Kuhlmann I.Q.'s with Stanford I.Q.'s (S_r) computed according to the Kuhlmann table (6, 232 ff.).

To obtain greater accuracy, we have redivided the 7–6 to 13–1 and the 13–2 to 15–11 groups into four sub-groups, II to V in Tables 1 and 2. These divisions were chosen so that the range of C.A. months within groups and the number of cases in each group should be comparable. Data from a previous article (1), for a 16–0 to 17–5 C.A. group, have been included in both tables.

INTERCHANGEABILITY OF INTELLIGENCE QUOTIENTS AND MENTAL AGES

When an inspection is made of Tables 1 and 2, at least three facts stand out. First, with the exception of one comparison, *i.e.*, group IV in both tables, the mean I.Q.'s and M.A.'s of the Revised Stanford are greater than the means of the Kuhlmann. Second, mean differences in I.Q. points between the two tests decrease as one descends from the higher C.A. groups to the lower; and third, below the age of 16–0, only the S–K mean I.Q. difference in group II (Table 1) is significant at the 1% level.[4]

Although a significant difference between the mean I.Q.'s or M.A.'s of two tests is a reliable indication that scores on these tests may neither be interchanged nor combined, the converse situation is certainly not true. Thus, while the significant differences obtained in groups I and II, Table 1, and in group I, Table 2, indicate that scores may not be interchanged within the specified ranges, the insignificant differences obtained for all other groups *do not* indicate that scores may be combined. In these situations, the two tests in question must satisfy at least two other conditions. First, they must cor-

[4] Before calculating the Fisher "t" statistic to test the significance of the difference between means, the writer has been careful to satisfy some basic assumptions: (1) The differences between the variances are insignificant (See the *F* test, Table 1). (2) The whole population between the specified age groups at the institution was examined. (3) Conditions of testing were rigidly controlled.

relate with each other to the same extent that one of the tests correlates with an alternate form or with a second administration of itself; and second, the per cent of subjects that differs from one test to the other by more than a stated number of I.Q. points must be equal to the per cent of subjects that shows these same differences between two forms or between two administrations of one test.

According to Terman and Merrill (8, p. 47) the median reliability coefficient for M.A.'s on the Revised Stanford (C.A.'s above 6–0) is +.92; and for I.Q.'s, in the range 70 to 89, is +.95. When these coefficients are compared with those in Tables 1 and 2, the Pearson *r*'s between the Kuhlmann and the Revised Stanford in all cases fall appreciably below the value obtained for the Stanford itself. These differences are accentuated by the fact that the reliability coefficients for the 1937 Stanford were based on two-month C.A. ranges. This would mean that the correlations listed in Tables 1 and 2 are somewhat inflated because of the wide C.A. ranges.

In Table 3 the differences between the I.Q.'s of the two tests have been compared with the differences shown by forms L and M of the Revised Stanford Binet. By calculating the average differences between the I.Q.'s of forms L and M, Terman and Merrill derived a $P.E._{I.Q.}$ (8, p. 46). For the ranges 70 to 89 this $P.E._{I.Q.}$ is $\pm$ 2.60. Using this value, the writer has calculated the per cent of cases that should exceed certain plus and minus I.Q. points of differences between forms L and M. These are listed in the bottom row of Table 3. For example, only 0.9% of the subjects who take both forms of the Revised Stanford should differ by more than $\pm$ 10 I.Q. points. When these criteria are compared with the differences which exist between the S and K and the S_r and K I.Q.'s, the extent of divergence between the Kuhlmann and the Revised Stanford may be readily seen.

With the exception of group V, the per cent of total subjects who differ in each group by more than the listed I.Q. points of difference is far greater than the criteria for forms L and M. Even group V, in three out of four comparisons, shows per-

TABLE 2

Mental Age and Correlation Data Concerning 186 Subjects with C.A.'s from 7–6 to 17–5 at the Minnesota School and Colony

C.A. group	No. of cases	Test*	Range of† mental ages	Mean† mental age	Sigma mental ages	Diff. between means $M_S - M_K$	*t* test (significance of $M_S - M_K$)	*F* test‡ for sigmas	Pearson *r*	*t* test of *r*
I 16–0 to 17–5	51	S	6–10 to 12–10	120.43	16.52	+5.41	3.34 P < .01	1.36 P > .05	+.71	9.3 P < .01
		K	7– 4 to 11– 8	115.02	14.16					
II 14–7 to 15–11	43	S	6– 2 to 14– 5	107.02	22.59	+0.90	0.50 P > .05	1.72 P < .05 > .01	+.79	17.8 P < .01
		K	5–11 to 12– 2	106.12	17.22					
III 13–2 to 14–6	31	S	5–10 to 11– 3	96.97	17.19	+0.55	0.21 P > .50	1.67 P > .05		
		K	5– 7 to 9–10	96.42	13.32					
IV 11–7 to 13–1	30	S	4–10 to 9– 4	85.93	15.72	−1.37	0.75 P > .05	1.54 P > .05	+.75	13.3 P < .01
		K	5– 2 to 9– 6	87.30	12.66					
V 7–6 to 11–6	31	S	4– 7 to 9– 0	79.39	11.55	+0.84	0.69 P > .05	0.00		
		K	4– 5 to 9– 2	78.55	11.55					

* S refers to the Revised Stanford-Binet, Form L, 1937.
K refers to the Kuhlmann Tests of Mental Development, 1939.

† Since the interval between the two testings ranged from four to eight months, a constant I.Q. was assumed and the mental ages were adjusted down to the C.A. of the earlier test.

‡ See footnote to table 1.

TABLE 3

Per Cent of Feebleminded Subjects in Each Group Who Differed in the Direction of the Revised Stanford-Binet, or the Kuhlmann by More Than the Stated Number of I.Q. Points

Chronological age range	Type of comparison*	I.Q. points of difference between the two tests			
		±3	±5	±8	±10
I 16–0 to 17–5	S and K	72.5	56.9	43.1	31.4
	S_r and K	66.7	35.3	27.5	11.8
II 14–7 to 15–11	S and K	58.1	44.2	32.6	16.3
	S_r and K	60.5	39.5	25.6	11.6
III 13–2 to 14–6	S and K	58.1	41.9	22.6	6.5
	S_r and K	64.5	45.2	16.1	12.9
IV 11–7 to 13–1	S and K	63.3	53.3	23.3	10.0
V 7–6 to 11–6	S and K	45.2	32.3	6.5	3.2
Based on Terman criteria	Forms L and M	43.8	19.6	3.8	0.9

* S has reference to the Revised Stanford-Binet I.Q.'s that have been calculated on the basis of the Terman-Merrill tables.
S_r refers to the Revised Stanford I.Q.'s that have been calculated on the basis of the Kuhlmann tables.

centages which are approximately from one and a half to three times larger than the L and M criteria. Further, it is obvious that a rescoring of the Stanford according to the Kuhlmann tables does not reduce the percentages in groups I through III to the size of the percentages calculated from the Terman-Merrill $P.E._{I.Q.}$ data.

Although the reasons for the differences which exist between the two tests may probably be traced back to methods of standardization, statistical procedures, and selection of subjects, one fact is clear from an inspection of both tests; namely,

that the individual tests on the Kuhlmann are similar to those on the 1937 Stanford up to the mental age of eight. From there on Kuhlmann consistently uses tests which differ greatly from those employed by Terman and Merrill. This situation may in part explain why the two tests differ at the higher chronological age levels than at the lower.

Because of the differences which have been found between the Kuhlmann Tests of Mental Development and the Revised Stanford-Binet, it may be concluded that experimenters and psychologists should not combine or interchange scores on these tests. This conclusion applies especially to the I.Q., C.A. and M.A. ranges which have been investigated by the writer. Without doubt, the next step should be the designing of an experiment to equate these tests at the various C.A. levels for both normal and mentally retarded populations. As a result of such an investigation, regression equations could be developed to predict scores from one test to the other.

SUMMARY

In this paper the writer proposed the hypothesis that within the chronological age and mental age ranges studied, I.Q.'s on the Kuhlmann tests could be interchanged and combined with I.Q. scores on the Revised Stanford-Binet. In order to test this hypothesis, the writer first eliminated from the population at the Minnesota School and Colony all subjects who had previously scored I.Q.'s under 50 on the Kuhlmann-Binet; all who could be classified as clinical types; and who had serious speech, physical or sensory handicaps. The 1937 Stanford-Binet, Form L was then administered to half of the 154 subjects, group A, and the Kuhlmann Tests of Mental Development to the other half, Group B. The Stanford was then administered to group B and the Kuhlmann to group A. Before comparing the I.Q.'s obtained by the subjects in the two tests, ten cases of reading difficulty were eliminated.

Because each test author computes I.Q.'s differently for certain ranges, the writer has first compared Kuhlmann I.Q.'s with Stanford I.Q.'s scored according to the Stanford tables

(S). Kuhlmann I.Q.'s were also compared with Stanford I.Q.'s scored according to the Kuhlmann tables (S_r).

When appropriate statistical procedures were applied to the data at hand, it was found, first, that the differences between the mean I.Q.'s and M.A.'s on each test were non-significant for groups III, IV, and V in all comparisons (Tables 1 and 2); for group II in the S_r and K I.Q. comparison; and for group II in the M.A. comparison. Second, coefficients of correlation computed between the Kuhlmann and the 1937 Stanford were in all cases lower than the reliability coefficients listed for the Stanford itself. Third, the per cent of cases that exceed certain plus and minus I.Q. points of difference are greater when the Kuhlmann and Stanford are compared than they are for form L and M of the Stanford.

The conclusion is that within the specified mental age and chronological age limits, I.Q.'s may neither be combined nor interchanged. This is true whether the tests are employed in the clinic for ordinary psychometric purposes or whether they are used as basic instruments for experimentation in educational psychology.

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A STUDY OF THE LURIA METHOD

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SINCE the publication of Luria's (7) report a number of papers by American investigators (1, 2, 3, 4, 5, 10) have appeared describing results obtained by the use of the method with varying types of subjects. An examination of these reports reveals considerable data indicating that the method tends to yield measures of rather satisfactory reliability. However, few data have been reported and some confusion has been evidenced as to the meaning and interpretation of the scores. Theoretically, in the Luria test, one obtains a manual record of disturbances in the central processes. These disturbances may be in the nature of inhibitions and blockings as well as disorganizations effected by intense emotional reactions. Luria (7) summarizes this point as follows:

> "In the cases which we have examined the combined motor method is a satisfactory reflection of the inhibited and the unexpressed parts of the associative process, and we may confidently expect that in expressing the structure of the organized process it is also capable of revealing the disorganization of this structure." (p. 32)

Luria's interests seems to have been primarily in the disorganizations as a result of severe emotional disturbances. This emphasis is very useful when one is working with criminals, subjects under extreme tension, such as candidates waiting for an important examination, and similar groups. However, in dealing with ordinary subjects under ordinary conditions it is important to recognize that emotional disturbances may vary in intensity and that under ordinary conditions problems which one dislikes and tries to avoid, when brought to the focus

momentarily, may produce but a mild affective reaction. At the same time, however, a definite tendency to inhibit and avoid may be present. Can the Luria test be used to detect those tendencies to inhibit and avoid under conditions of but mild affective reactions?

Problems arising from the inability to reconcile opposing desires or the inability to bridge the gap between desire and ability to attain and which the subject dislikes and tends to avoid may be termed "conflicts," if we may use the term with a somewhat broadened meaning to apply to normal subjects. Our problem then becomes, does the Luria method detect the presence of "conflicts" of this character?

In a study of the effect of a learning program designed to develop an understanding of human behavior in personal and family relationships, students from a university community and young employed men and women, all between the ages of eighteen and twenty-five, were used as subjects. Extensive data were obtained from each subject at the beginning of the program. These data include, in addition to the Luria test scores, scores on an attitude test, a self-report blank on which the subject wrote answers to pertinent questions, and data from carefully planned interviews. In addition, records were available of the reactions of the subjects during group meetings which formed a part of the learning program. Furthermore, a number of subjects used in the study had been known personally to at least one of the investigators for periods varying from one to three years. Since Luria records and extensive data throwing light on the problems faced by the subjects were available it was possible to study the relation of the former to the latter. It is the purpose of this paper to report the results of such a study.

The word list used in the administration of the Luria test included words ordinarily associated with the four areas, "home," "companions of both sexes," "school or work," and "general outlook on life." The question to which the data presented in this paper apply may be specifically stated as

follows: to what extent do the various measures obtained by the Luria procedure reveal the presence of conflicts in the areas relating to parents, companions, work or school, and general outlook? The approach to this question involved taking all available data exclusive of Luria records of all the subjects known to at least one of the investigators for one or more years, classifying the subjects into high, intermediate and low conflict groups, and then comparing the Luria test scores for the three groups.

A total of thirty-six subjects were classified. These were all the subjects that the investigators felt were known to them sufficiently well to make reliable ratings. All subjects for whom the two raters disagreed by more than one step were excluded. When the ratings disagreed by one step the category toward the lower conflict end of the scale was used.

In an investigation of this type it is important to describe in some detail the meaning of the three categories into which the subjects are classified. As indicated above the term "conflict" will be used with a somewhat broadened meaning. A high conflict rating is used in this study to designate those individuals who have personal and social problems which they have not solved, which they feel incapable of solving, and toward which they have developed an attitude of dislike to the extent that they tend to repress or inhibit a discussion of them. This feeling of inability to solve problems may evidence itself in many ways. Some subjects may feel very dogmatic and sure of themselves yet they resist a discussion of a problem, show negativistic reactions to new data, and give other indications that they fear the changes essential for integrating new data into their attitudes and behavior. Others give evidence of having adopted a somewhat fatalistic attitude.

In contrast to the subjects receiving a high conflict rating are the subjects classified in the low conflict group. Subjects in this group give evidence of adopting a more objective attitude toward their problems. They give evidence of feeling relatively secure to the extent that they are willing to discuss

their problems. They give few indications that they fear new data but rather seek them and attempt to integrate them into their attitudes. In their home relationships, for example, they give evidence of feeling a sense of belonging to the family yet they are self-directing individuals. If differences of opinion exist in their family they are working toward a solution.

Subjects not classified in the high or low conflict groups were placed in the intermediate group.

The concepts of "high" and "low" conflict ratings may be further explained by brief descriptions of individual cases:

> Subject SEW #15 in the high conflict group is a type of person who gives evidence of tension both physically and mentally. She is very proud of her parents' achievements, although outstanding difficulties appear when her pride in her parents and their high goals for her clash. On the self-report blank, for example, in describing family relationships to the subject stated that "they (the parents) have set up goals for me but I have not had any say about them. Their idea has been 'you are to be a Phi Beta Kappa.' You come to feel that by fair means or foul a good grade must be forthcoming. The outsider would probably say that I had gotten on quite well. I believe that I have failed miserably to come up to the standards of which I am or was capable. As a result of my continual disappointments, first in my leadership in college and then grades, I have lost confidence in my abilities. So far, my family has not aided me in gaining confidence. Their praise is only for actual accomplishments and a miss, however close, is condemned. And there is no attempt to understand. I feel sure that if my parents were aware of the situation they could help. But as we have no intimate relations I certainly shall not tell them. The gap is too great now."

This subject's contributions to the group discussions were in the nature of personal outbursts, in spite of the fact that she is a rather intelligent person.

> Subject SEM #20, in the high conflict group, rates as superior in intellectual ability on mental tests, but fails to achieve accordingly. In the interview and self-report

blank he gave the following data. "I thought I'd be a ———— (professional occupation) but my grades are not good enough. I can work math problems but I don't trust my answers. My brother did not make a success of his work. He is home on dad now. Dad lost confidence in himself when he lost his job during the depression."

As indicated in this quotation this subject is very uncertain about his vocational plans and is worried about them. During the interview he suggested four very different possibilities interspersed with such remarks as:

"it is pretty unsettled," "it is a kind of frustration in my life." In the discussion group a few times he would make objective and helpful contributions but these were interspersed with very highly personalized and often irrelevant remarks which tended to indicate that he was trying to attract attention.

In contrast to these subjects in the high conflict group SEM #2 and SEW #21 in the low conflict group. Regarding his family relationships SEM #2 writes,

"I have fortunately come from a family of limited means but enjoy good health. I have been on my own financially since a junior in high school but I have qualities from my very plain farmer parents which will stay with me much longer than any pecuniary aids they might have given me.

"I am a freshman law. I have always wanted to be a lawyer. To make my way through school I am a proctor in a dormitory. On the side I do some labor for the university stores. I use the work as exercise and release from the grind of study. Although I earn every cent of my way I try to go to many university parties.

"It is hard for a proctor to tell how he is liked by his college mates but I think I am liked more as a person than as a proctor. I don't make a very great effort to be popular with girls at present as I am engaged but I have never had trouble getting along with them. My problem is to know when is the time to get married. If too early, would it be a deterrent to that future goal? My fiancee has a college debt. She desires for us to marry and for her to work but whether to wait a year or two, that is the question."

SEM #2 was an invaluable member of the discussion group. He was honest in his contributions, eager for new data, showing unusual alertness to integrate them into his thinking.

Subject SEW #21 is a highly intelligent girl with charm and musical ability added. She seemed to have considerable ability in evaluating her assets and liabilities as shown by the following:

> "I feel that my family is reasonably proud of me and that they would heartily approve of improvements in other respects.
>
> "I think my scholastic ability is somewhat above average as shown by my grades. As yet I have not made the most of my potentialities."

Speaking of some rather remarkable honors she had taken in music, she closed with the following, "however I failed to qualify for the national contest in solo work."

She feels that she has many friends among her own sex. Regarding her attitude toward the opposite sex she wrote,

> "I do not sweep the stag line by storm or get dated up months in advance but I have a few who date me and one or two have cared for me more than an ordinary friend."

She made relatively few contributions to the discussion group meetings but when she did contribute it gave the impression of being on the same balanced, objective level as indicated in the above quotations.

What relations exist between the ratings and scores on the Luria test? In administering the Luria test the central processes were brought into play using a list of one hundred words. The words were given in one sitting at approximately five-second intervals using the preferred hand for the voluntary motor response and the non-preferred for the involuntary motor response. Both arms rested the full length of the forearm on a firm platform leaving the hand free to move. The two forefingers were placed on the recording levers. Measures of reaction time and verbal responses were obtained in addition to the motor performance. The records were not analyzed

nor the scores totaled until the conflict ratings had been completed.

In Table 1a are given the number of subjects in each of the

TABLE 1a

Means of Voluntary Responses in High, Intermediate and Low Conflict Groups

Group	N	M	εd^2
High conflict	14	46.21	2641.35
Intermediate	11	31.45	88.70
Low conflict	11	14.90	342.91

three conflict groups, the means of the number of disturbances in the voluntary performance and the sum of deviations for each group. The table gives all the data necessary to apply the "t" test to the significance of differences between means. The value of "t" as obtained for the several differences and the value of "t" at the one per cent level of confidence are given in Table 1b. An analysis of the data in the latter table

TABLE 1b

Significance of Differences between Conflict Groups in Voluntary Responses

Difference	t	Value of "t" for 1% level of significance
M high – M low	6.83	2.807
M high – M intermediate	3.37	2.807
M intermediate – M low	8.40	2.845

shows that all the differences among the three groups are significant well beyond the one per cent level.* In other words, the disturbances in the voluntary responses differentiated significantly the three conflict groups.

* The differences in variance between "high" and "intermediate" and between "high" and "low" groups are large since there is no *a priori* method of controlling this. Hence these values must be interpreted carefully. However, variances in table 2a permit a more effective comparison.

In the Luria test a record of the disturbances in the involuntary responses are also available. It is interesting to examine how the scores on the combined voluntary and involuntary groups compare. The essential data are given in Tables 2a and 2b. All of the differences are significant well beyond the one

TABLE 2a

Means of Combined Voluntary and Involuntary Disturbances in High, Intermediate and Low Conflict Group

Group	N	M	σd^2
High conflict	14	59.07	826.86
Intermediate	11	38.81	511.57
Low conflict	11	18.81	213.57

TABLE 2b

Significance of Differences between Conflict Groups in Combined Voluntary and Involuntary Disturbances

Difference	t	Value of "t" for 1% level of significance
M high – M low	14.90	2.807
M high – M intermediate	6.59	2.807
M intermediate – M low	7.81	2.845

per cent level. We would expect this since in normal subjects under the conditions prevailing in this test the disturbances in the voluntary responses tend to outnumber considerably the disturbances in the involuntary. Thus the combined totals consist largely of disturbances in voluntary responses.

The Luria test as administered in this study also includes a record of the verbal responses of the subject. It is interesting to inquire into the nature of the responses of the three conflict groups. Many years ago Jung (6) and others worked out a rather detailed method of analyzing verbal reactions obtained in association tests. Jung's claims relative to the significance of verbal responses were probably exaggerated and

it is doubtful whether he was able to obtain reasonably high reliabilities with the very detailed classification he used. The writers have found it necessary to telescope Jung's long list of categories into some twelve groups to obtain reliabilities in the neighborhood of 85% to 90% agreement between two observers in classifying verbal responses. For this coarser grouping reliabilities seem reasonably satisfactory.

The chief value of the verbal responses is the light they throw on the qualitative nature of the central processes. Since the qualitative nature of these processes is extremely variable even among subjects of a given conflict group (that is, subjects have different problems, they have different methods of solving them, etc.), we would expect considerable variation in the verbal responses. Nevertheless, it is interesting to inquire whether any tendencies can be observed in the three conflict groups. Keeping in mind the variability of the central processes we may formulate certain "trend" hypotheses. For example, in the high conflict group we would expect a higher proportion of indirect, egocentric, and, since there is a tendency to avoid problems, a higher proportion of omitted responses than in the low conflict group. We may also expect a somewhat higher proportion of predicate relationships since the predicate relationship group is largely made up of judgments of value which tend to be judgments motivated by desire or fear.

On the other hand we would expect the high conflict group to yield a lower proportion of the more objective and more logical responses such as causal dependence, coadjunction, coexistence, and the like. What do the analyses of the three conflict groups reveal? The data are summarized in Table 3. In this table data for such categories as contrast, word-complement-change, identity, motor speech forms, and repetition of the stimulus words are omitted since the number of responses falling in these groups is small. Each of these categories includes a relatively large number of zero scores.

An analysis of the data presented in Table 3 will show

TABLE 3

Significance of Differences in Verbal Response

Category	Differences	t	t sig. at what level
Coadjunction	high – low		
	9.7 17.3	3.55	less than 1%
	high – intermediate		
	9.7 14.0	2.55	less than 2%
	intermediate – low		
	14.0 17.3	1.29	beyond 5%
Predicate relationships	high – low		
	27.2 15.2	3.63	less than 1%
	high – intermediate		
	27.2 23.5	1.03	beyond 5%
	intermediate – low		
	23.5 15.2	2.77	less than 2%
Causal dependence	high – low		
	5.2 9.0	2.12	less than 5%
	high – intermediate		
	5.2 4.7	.67	beyond 5%
	intermediate – low		
	4.7 9.0	2.29	less than 5%
Coexistence	high – low		
	19.7 26.3	2.12	less than 5%
	high – intermediate		
	19.7 18.9	.25	beyond 5%
	intermediate – low		
	18.9 26.3	2.65	less than 2%
Combined scores of indirect, egocentric, and fault	high – low		
	27.1 10.90	3.53	less than 1%
	high – intermediate		
	27.1 24.3	.52	beyond 5%
	intermediate – low		
	24.3 10.90	3.09	less than 1%

that the hypotheses we have just stated are abundantly verified when we consider the extreme groups, that is, the high and low conflict groups. The differences between the two groups in number of coadjunction responses, predicate relationships, and a combination of indirect, egocentric, and omissions are all significant below the 1% level. And the differences are in

the direction we would expect, that is, the low conflict group yields the greater number of coadjunction responses while the high conflict group yields a significantly greater number in the predicate relationship and in the indirect-egocentric-omission categories. The differences in causal dependence and coexistence when considered separately are significant below the 5% level with the low conflict group yielding the greater number of responses as we would expect from the above hypotheses.

In the intermediate comparisons, that is, high vs. intermediate or intermediate vs. low roughly half of the differences are significant below or near the 2% level.

On the other hand our suspicion of greater variability in the verbal responses tends to be verified by the fact that the intermediate comparisons are, in only roughly half the cases, significant below the 2% level and in the other half significant only beyond the 5% level. Analyses of the responses of individual cases become rather interesting as indicated in other studies by the writers (8) but they are beyond the scope of this paper. It is sufficient here to indicate the trends.

The results of this investigation tend to indicate that the manual responses in the Luria test differentiate the three conflict groups at a high level of confidence. All differences in manual responses are found to be significant below the 1% level of confidence. The verbal responses obtained in the test yield certain tendencies such as a higher proportion of the more personalized and predicate relationship type of responses and a lower proportion of the more logical and objective types when the high conflict group is compared to the low conflict group.

The results obtained in this investigation do not seem in the opinion of the writers to be at variance with such data as those reported by Reymert and Speer. Reymert and Speer (9) presented subjects with arithmetical problems of increasing difficulty. They found an increasing number of voluntary disturbances as the subjects attempted to solve the more difficult problems. It would seem reasonable to expect more hesitation and "checking" before answering as the problems become more

complicated. Also, we may expect an increasing anxiety as the problems become more difficult. The hesitation and "checking" before answering and the possible anxiety would seem to be somewhat comparable to what the subject experiences when he is reminded of an unpleasant experience and inhibits one response while attempting to find another. In other words, all these data seem to indicate that the "combined motor" method tends to be a "reflection of the inhibited and unexpressed parts of the central processes."

The Luria test appears exceedingly useful in distinguishing conflict groups of the type described in this study.

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LAST VS. USUAL PURCHASE QUESTIONS

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THE use of the questionnaire in market research has led to increased interest in the problem of the form of the question. One wishes to present the respondent with questions which will enable him to answer as easily and as correctly as possible. Although there are many instances where a respondent's interpretation is desired, it is the consensus of opinion that some situations necessitate specific questions which leave the respondent little or no need for interpretation. In the market research field at least, this has led to extensive use of the so-called "last purchase" or last performance question in determining product usage, for example, "What brand of cigarettes did you buy last?" The question immediately arises as to whether the answers received from this type of question will give an actual picture of brand usage, that is to say, the most usual behavior of the respondent. If one is asked what one usually purchases, will the answers correspond more closely to actual purchases than if one is asked what one purchased last?

It may be true that a usual purchase question allows the subject to respond in a way which he considers more favorable to him, whereas a last purchase question may give him less chance to give responses which he thinks reflect favorably on him. Thus he may say that he usually purchases a more expensive brand of hat than he actually does but when questioned as to his last purchase he may respond with a more accurate answer as a result of the greater specificity of the question. However,

* This study was carried out while the author was at the University of Maryland.

if the two types of questions give different results it might be necessary to ask both questions.

Since the full cooperation of the respondents is sought, it is usually desirable to limit the overall length of the questionnaire as much as possible and at the same time obtain all pertinent information. It will be readily acknowledged that in individual cases the answers to the two types of questions may not correspond, but since most behavior preference studies are concerned with responses of groups and not with individual answers, the question arises as to whether it is sufficient to ask only one of the two types of questions, and thus to minimize the overall length of the questionnaire. First, however, we must determine whether the two types of questions would yield comparable results. If no significant difference between the answers is obtained it would seem wise to use the question yielding the more specific response. This study was made to determine whether any stable group difference in results would come from the two types of questions.

The subjects were two groups of college students from the University of Maryland, Group 1 consisting of 133 men and 91 women, a total of 224; and Group 2 consisting of 138 men and 76 women, a total of 214. The subjects were students in Psychology and Economics and no effort was made to match them. Two questionnaires were prepared, one to be presented to each of two groups, hereafter referred to as the "Last Purchase Group" and the "Usual Purchase Group." Each questionnaire consisted of 24 questions, 6 designed especially for men, 5 designed especially for women, and the remaining 13 for men and women. One questionnaire consisted of usual behavior questions and the other of the corresponding last behavior questions; for example, the last purchase questionnaire contained the question, "What brand of cigarettes did you buy last?" while the usual purchase questionnaire had the question, "What brand of cigarettes do you usually buy?" Other questions referred to razor blades, shaving soap, hair tonic, pipe tobacco, shaving lotion, and the number of razor

blades used per week for men; for women, face powder, lipstick, hair shampoo, nail polish, and hosiery; and for both sexes, brands of gasoline, tooth paste, hats, toilet soap, and shoes, and in addition the number of glasses of milk drunk per day, number of times teeth were brushed per day, number of Coca Colas drunk per week, number of pairs of shoes bought per year, and number of hats bought per year. No formal instructions were deemed necessary but the experimenter asked the students to respond as accurately as possible. All questionnaires were presented during regular class periods and the subjects were given ample time to fill them out.

The results were tabulated according to the number of persons responding in a certain way. Table 1 shows the data

TABLE 1

Distribution of Answers to Brand of Cigarettes

Brand cigarettes	Last	Usual	P
Don't Use	60	70	Greater than .02
Don't Know	0	2	" " "
Camels	31	21	" " "
Luckies	8	6	" " "
Chesterfields	15	15	" " "
Philip Morris	6	13	" " "
Old Golds	7	1	" " "
Dunhill	2	0	" " "
Her. Tarryton	2	1	" " "
Raleigh	1	2	" " "
Wings	1	0	" " "
Sensation	0	2	" " "
Regent	0	1	" " "
	N = 133	138	

obtained from the questions, "What brand of cigarettes do you usually buy?" and, "What brand of cigarettes did you buy last?" The last column represents the probabilities of obtaining Chi Squares as large or larger than those obtained through random errors of sampling. Since without exception all proba-

bilities are greater than .02 this indicates that there is no difference in results from the form of the question. Space was left on each questionnaire for Don't Use and Don't Know responses. It should be noted that 133 men received the questionnaire consisting of last behavior questions. Of these 133 men, 60 said that they didn't use cigarettes, none said that they didn't know what brand they last bought, 31 last bought Camels, etc. Of the 138 men who filled in the questionnaire consisting of usual purchase questions, 74 reported that they didn't use, 2 didn't know what brand they usually smoked, 21 smoked Camels, etc. This same procedure was followed for each question. In this particular example only 13 comparisons were necessary, but in some cases as many as 49 comparisons had to be made for one question since the number of comparisons made for each question depended upon the number of different brands named.

The Chi Squares were determined for each comparison as shown in Table 2, *i.e.*, number of persons responding in one

TABLE 2

Chi Square Table for Camel Cigarettes

	Last	Usual	Totals
Camels	31	21	52
All others	102	117	219
Totals	133	138	271

fashion on the last questionnaire against all others, and number of persons responding in the same fashion on the usual questionnaire against all others.

The Chi Square of 2.09 for this table tells us that the ratio of Camel buyers in the last Purchase Group to the Camel Buyers in the Usual Purchase Group is not significantly different (*i.e.*, P is greater than .02) from the ratio of All Others in the Last Purchase Group to All Others in the Usual Purchase

Group. If we obtained a Chi Square yielding a P of less than .02 we might interpret the difference between the ratios as a function of the form of the question. It will be noted that, since N is limited, any differences found make other compensating differences between preferences necessary. Thus *one* significant difference should tend to make for *other* significant differences on that particular question.

Since a large number of comparisons were made, the exact Chi Square was not computed for every comparison. A Chi Square of 5.412 or over is usually considered significant (P = .02), and whenever it was certain that the Chi Square would fall over or below 5.412 the appropriate judgment of significant or non-significant was made. Whenever there was any doubt as to the significance or non-significance of the difference, the exact Chi Square was computed and the comparison placed into the correct category.

For the men, there were 307 comparisons made, 5 of which resulted in significant differences. These differences were found in four questions as follows: the answer "Texaco" to brand of gasoline, the answer "Squibbs" to brand of toothpaste, the answers "Colgates" and "Williams" to brand of shaving cream, and those answering "None" to number of Coca Colas drunk per week. The directions of the differences were not consistent.

For the women, there were 365 comparisons made, 5 of which resulted in significant differences. These differences were found for four questions as follows: the answer "Red Cross" to brand of shoes, the answer "Cocoanut Oil" to brand of hair shampoo, and the answer "Don't Know" to brand of shoes and to brand of lipstick. Again the directions of the differences were not consistent.

By chance alone two differences in 100 will exceed the statistical criterion of significance. In the comparisons made with men, 5 out of 307 appeared to be significant, whereas 6 might be expected to be significant purely on a chance basis. Similarly with the women, 5 out of 365 differences appeared to be

significant whereas one might expect 7 significant differences on a purely chance basis.

The data were also analyzed to determine whether there were any significant differences between the Don't Know answers on the two questionnaires. Two significant Chi Squares out of 34 comparisons were found, both classified under the female responses. One was in response to the question "What brand of shoes do you usually (last) purchase?" and the other in answer to the question, "What brand of lipstick do you usually (last) buy?" In both cases there was a significantly greater number who responded Don't Know to the Usual question.

It was also interesting to compare those who answered "None" to each type of question. Here two significant differences were found, out of 34 comparisons, one for each sex, and both in answer to the question "How many Coca Colas do you usually (last) drink per week?" In each case more persons answered "None" a greater number of times on the Last Purchase type of question.

On another questionnaire which had previously been distributed among 156 college students concerning their cigarette smoking habits, the questions, "How many cigarettes do you usually smoke per day?" and later, "How many cigarettes did you smoke yesterday?" were asked. The answers to these questions allowed a comparison of the answers to the two types of questions as answered by the same people at the same time. Again Chi Square was employed. Thirty comparisons were made and 2 significant differences were found.

DISCUSSION OF RESULTS

For the samples used in this study, 672 comparisons were made between answers received from 24 questions asking the respondent his *usual* behavior and the corresponding questions asking the respondent his behavior when *last* in the situation. Of these 672 comparisons, 10 resulted in significant differences. By chance alone 13 would have been expected.

When the data were analyzed to determine whether there

was any difference between number of answers of Don't Know on either type of questionnaire two significant differences were found. An analysis of "None" responses also resulted in two significant differences. In another study including the two types of questions, 30 comparisons were made, 2 of which were significant. Thus a total number of 702 comparisons yielded 12 significant differences; 14 differences being expected from chance alone.

In reference to the samples used in this study, therefore, it may be said that the two questions result in comparable answers for the most part when the results are treated for groups rather than individuals. In measuring the brand preferences of this group, trends could be established as accurately from the last purchase questions as from the usual purchase questions.

THE DEVELOPMENT OF AN ANXIETY SCALE

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INTRODUCTION

THE tremendous importance of anxiety states in the development of various "types" of mental disorders is attested to by case records. Psychologically, anxiety states may be considered as arising from conditions which threaten the security of the individual or threaten the stability of social norms and values which have become integrated and organized within the individual as a result of his past experience. These integrated systems of values have been designated by various writers as "frames of reference."[1] We may expect to find the incidence of anxiety states increasing as conditions which endanger prevailing values become more acute. This point may be illustrated by reference to a current situation.

In the first World War anxiety states were frequently found to presage the later appearance of the more serious forms of neuroses. Recent reports coming from England seem to be in accord with this earlier observation. In the present World War, civilian populations of large cities are subject to regular air raid attacks with their resultant bombings and dangers to continued existence. These attacks present a constant threat to a very fundamental value, the preservation of life. While full protection or security is impossible, if left to himself the average individual might resort to any pattern of behavior which at the time seems appropriate to protect this value. This in itself is enough to lay the foundations of anxiety, but the problem is complicated and nurtured by social factors working in opposition to uninhibited behavior. Other values

[1] For a discussion of the concept of "frame of reference" see: Allport (1), Cantril (2), Edwards (3), and Sherif (8).

such as the desire to impress others as being unafraid and the desire to make one's apparent behavior conform to socially approved norms are active also. Consequently, the overt adjustment which may seem to the individual to be most closely related to security, may be prevented because of existing social norms.

The potential threat of future attacks contributes to the prolongation of feelings of insecurity, while the seemingly calm behavior of other civilians and government propaganda continue to act as a force to suppress or inhibit overt expression of these very same feelings.[2] Hence, this conflict between the desire to live and the desire to impress upon others that one is not afraid to die is not a temporary one which is active only during actual attack. Its effects are found in behavior symptoms which may remain long after the immediate danger is over.

The clinical manifestations of this conflict have been described by Noyes (6) as a " . . . constant state of emotional excitability, apprehensive expectation and foreboding which is subject to paroxysmal exacerbations of intensity. During these acute anxiety attacks the conspicuous symptoms are associated with activity of the vegetative nervous system and correspond to many of the physiological signs of fear. The patient suffers from rapid heart, palpitations, nausea, diarrhea, desire to urinate, dyspnea and a feeling of choking or suffocation. The pupils are dilated, the face is flushed, the skin perspires, the patient suffers from paresthesias, tremulousness, feels dizzy or faint, and often has a sense of fatigue

[2] Our discussion of this selected example should not be taken to indicate that anxiety states appear only under conditions which endanger life itself. On the contrary, anxiety states may develop under *any* condition which offers real or imagined danger to *any* value. Thus crises of all sorts, depressions and periods of social change, may be expected to contribute to their growth and development in the general population. In addition, anxiety states may develop in specific individuals as a result of apparent threat to such diverse values as successful sexual relations, health, business success, and others.

and impending death. Restlessness is acute and the patient may express beseeching and apprehensive appeals." Anxiety states, then, are an expression of apprehension, insecurity, tension and worry, which may develop in degree to the extent of seriously interfering with adjustive behavior.[3]

There are two major difficulties which the clinician must face in the treatment of anxiety states. First, he must by some means or other enable his patient to verbalize his troubles, and second, once the problem is verbalized there is the matter of getting the patient to recognize its source of origin. These two aspects of treatment are not unrelated. Theoretical bias, however, may determine the approach which any one clinician may use in interpreting the source of a particular anxiety, while verbalization upon the part of the patient seems to be a more or less recognized aspect of treatment used in common by many clinicians of differing creeds. It appears that verbalization of the anxiety state is apparently the first step in the successful release of tensions which have accumulated because of the influence of certain social forces which have tended to prevent their normal expression.

The problem of verbalization is not a simple one. The patient may be unable, for one reason or another, to put his anxiety into words. The clinician is then left with the alternative of suggesting possible areas based on his knowledge or past experience with similar cases, or of spending many hours in careful questioning and consultation in an effort to draw his patient out. It is needless to point out that any device which might shorten the time necessary in getting the patient to verbalize and which might also indicate the particular nature of the anxiety state would be of aid to the clinician. It is with this phase of the problem that the present paper is concerned.

PROBLEM

The possible things about which any one individual may

[3] Cantril (2) has recently published an enlightening analysis of anxiety states in relation to "panic" behavior.

worry are innumerable. Granting this point, we may then proceed to raise the question as to whether there are not major areas of worry. More specifically, is it not possible that there are certain areas of worry which are common to many individuals, the difference here being only one of extent? For example, health may be one of these common areas, the major difference between the normal individual and the hypochondriac being the degree to which this particular subject is worried about and the resultant degree to which it is allowed to influence their respective behavior.

In this study the responses of college students to a *composite* scale covering six broad areas of worry similar to the one mentioned above were investigated. These areas have been termed: *health; contemporary affairs; sex; social relations; persecution;* and *neuroticism.* It should be clearly understood that these labels are merely labels and are used simply to designate a general heading under which could be classified a related group of specific worries. A brief discussion of how the items used in the scale were selected will perhaps clarify this point.

METHOD

Part IV of the Pressey X–O test (7) was used as a base. Each of the 125 words in this section of the X–O test is related to something about which a suspicious, a neurotic, a self-conscious, a melancholic, or a hypochondriacal person, might worry. This means that there are 25 words relating to each of these five classes. Subjects are instructed to cross out all of the words which symbolize things about which they have felt nervous or worried. The reliability of the total scores (combined five classes) on this section of the X–O test has been reported by McGeoch and Whitely (5) as being .87. The coefficient is based on test-retest scores (48 hour interval) of 64 college students.

To Pressey's original classes one new one was added. This sixth class consisted of words dealing with sexual worries. In addition, the number of words in each of the classes was in-

creased. These additional words were taken from various sources, including clinical case books and existing neurotic inventories.[4] Altogether over 600 words were collected. However, many of these revealed overlapping, *i.e.*, they were symptomatic of several of the areas and were eliminated for this reason. The preliminary experimental scale was thus eventually limited to 58 words for each of the six areas or a total of 348 words. The words were arranged in the scale in groups of six, one word from each area, and so that they followed a variable order.

It should be clear that much of the task of classification is almost arbitrary. The groupings which we have made are definitely not the only classifications possible. Many of the words which might have been classified differently by the writer, were assigned to another area simply because other authorities seemed to be in agreement. It may be pointed out that examination of the scale reveals that there is a certain degree of relatedness among the words in any one area and each area seems to be getting at something different from the others.

The scale was first given to a group of graduate psychology students at Ohio State University. Questioning of these students after they had filled out the scale revealed that they were unaware of the relationships between the various words. They were then told the purpose of the scale and given a brief description of each of the six areas. Upon being told to select the words from each sub-group which belonged to each of the major areas, they were generally able to accomplish this with little difficulty. The eight words, however, in each scale which proved to be the most perplexing were eliminated. This preliminary tryout of the original scale would seem to offer further evidence concerning the relatedness of the final 50 items retained within each particular scale and the independence of items with respect to scales other than the one in which they have been classified.

[4] It was found, in many cases, that an item in one of the inventories could be reduced to a single key word.

The scale was then given to 349 students in psychology and education classes at Northwestern University and Kansas State College with the following instructions:[5]

> You know that there are things about which people worry or feel nervous or anxious. This is an attempt to discover some of those things and your cooperation is requested. Frank answers will be appreciated. You understand that this is not a test of intelligence or of how much you know. There are no right or wrong answers. You are to indicate, by placing a cross (X) on the line in front of the word, all of those things about which you have worried or felt nervous or anxious. Indicate, by placing a circle (O) on the line in front of the word, all of those things about which you have not worried or felt nervous or anxious. Work rapidly. Your first impressions are desired.

The subjects ranged in age from 17 to 26 years. There were 152 men and 197 women who filled out the scale.

RESULTS

The scales were scored on the basis of one point for each word marked by an X. Scores were figured separately for each of the six scales. As a check upon the classification of the items and in order to find out whether the individual words would successfully discriminate between those subjects making high scores and those making low scores on each scale, an upper third-lower third item analysis was carried out. That is, the responses to each item of the 115 subjects making the highest scores were compared with the responses of the 115 subjects making the lowest scores.[6] Statistically significant differences between the two groups were found for the various items and the scales, therefore, meet the criterion of internal consistency.[7]

[5] The writer wishes to express his appreciation of the assistance of A. R. Gilliland and R. H. Seashore of Northwestern University and M. C. Moggie of Kansas State College in the collection of the data.

[6] *Cf.* Lentz, Hirshstein, and Finch (4) for an evaluation of various methods of item analysis.

[7] Acknowledgment is made to Miss Louise Walker and the National

The reliability coefficients for each of the six scales are presented in Table 1. These coefficients, according to data summarized by Stagner (9), are as high as those generally found in the measurement of other aspects of personality by means of questionnaires.

TABLE 1

Reliability Coefficients of Each of the Anxiety Scales

Scale	N	Split-half reliability	Spearman-Brown estimate for whole test
Sexual anxiety	349	.84	.91
Neurotic anxiety	349	.84	.91
Health anxiety	349	.81	.90
Persecution anxiety	349	.84	.91
Contemporary affairs anxiety	349	.85	.92
Social relations anxiety	349	.88	.94

In Table 2 are presented the tentative percentile norms for each of the scales for college men and women. These percentiles were found graphically by means of a cumulative frequency graph and therefore are only close approximations. It should be emphasized that they are based on the sample which we have already described and comparison of scores made by others to these norms must be made with great caution.[8]

Table 2 gives the mean scores of the 152 college men and the 197 college women on each of the scales. It is apparent that college women tend to worry more about things relating to social relations and persecution than about any of the other four areas. Sexual anxiety ranks only fifth. For the college men we also find that social relations and persecution

Youth Administration for assistance in carrying out many of the computations reported in this study.

[8] Space limitations prevent the publication of the 300 words included in the scale. Copies may be obtained from the writer, however, upon request.

TABLE 2

Tentative Percentile Norms for the Anxiety Scales

152 college men

Percentile	Raw scores					
	Sexual	Neurotic	Social	Hypochondriacal	Contemporary	Paranoid
99	40	45	48	40	46	49
95	36	38	43	34	41	47
90	32	34	42	30	37	45
85	29	32	40	28	34	43
80	27	29	38	26	31	40
75	25	27	36	24	29	38
70	23	25	34	23	26	35
65	21	23	32	21	24	33
60	19	21	30	20	22	29
55	17	19	28	18	21	26
50	15	17	26	16	19	24
45	13	15	24	15	17	21
40	11	13	22	13	15	19
35	10	12	20	12	13	16
30	8	10	18	10	11	14
25	7	9	16	8	10	12
20	6	8	13	7	8	10
15	4	6	11	5	6	8
10	3	5	8	3	4	6
5	2	3	5	2	2	3
	197 college women					
99	49	48	49	46	46	49
95	41	42	47	36	42	48
90	37	37	44	31	38	45
85	34	33	43	28	34	44
80	31	30	41	25	31	41
75	28	27	39	23	28	39
70	26	25	37	21	25	36
65	23	22	35	20	23	34
60	21	20	33	18	21	32
55	19	18	31	16	19	29
50	18	16	29	15	17	26
45	16	15	27	14	15	24
40	15	13	25	12	14	22
35	13	12	22	10	13	19
30	12	11	20	9	11	17
25	10	10	18	7	9	15
20	9	9	15	6	8	12
15	7	7	12	5	6	10
10	5	6	9	3	5	8
5	3	4	6	2	3	5

take first place in importance as a source of anxiety. We should expect to find sex differences only if there are cultural factors at work which operate differently on the two sexes. These factors seem to be most clearly reflected in the case of sexual anxiety, women being more concerned over this area than men. The critical ratio for the difference between the means is 2.35.

TABLE 3

Mean Scores of College Men and Women on Each of the Anxiety Scales

Scale	197 women		152 men	
	Mean	σ_M	Mean	σ_M
Social relations anxiety	26.47	1.05	27.75	.92
Paranoid anxiety	25.52	1.19	26.20	.99
Contemporary affairs anxiety	21.05	1.04	19.36	.85
Neurotic anxiety	19.06	.95	19.17	.81
Sexual anxiety	17.02	.95	20.00	.84
Hypochondriacal anxiety	16.92	.86	16.06	.73

So far as the words contained in our scales relate to the various areas—and the validity of the lists is of course subject to question—the main worries of college students of today seem to be concerned with things relating to "getting along with others" and to "fair treatment." Sex, according to our findings, does not deserve the overemphasis that it is sometimes given by psychoanalytically inclined clinicians and worried deans of students. Instead the point of grave concern seems to be the relative importance which attaches to words relating to persecution. It cannot be determined from the available data why anxiety over "quarrels, defeat, sarcasm, nagging, rivals, criticism," etc., should play such an important role in the life of college students, but it is interesting to raise the question as to whether the general population shares these same anxieties, or whether there is something within the college structure itself which makes them specific to college students.

SUMMARY

An anxiety scale designed to indicate various areas of worry was constructed. These areas were designated as: *sex; persecution; social relations; contemporary affairs; health;* and *neuroticism.* Item analysis of the various scales showed that each item reliably discriminated between subjects making low scores and those making high scores on each scale. Furthermore, the reliability coefficients of each of the scales were found to be comparatively high. It is suggested that the scale may be of value to the clinician as a means of discovering the particular area of a patient's anxiety and as an aid in enabling him to verbalize his problem.

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THE EFFECT OF PRACTICE ON VARIOUS ELEMENTS USED IN SCREW-DRIVER WORK

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BECAUSE of changes in the design of products; because of improvements in manufacturing processes; and because of the desire on the part of management to stabilize employment, it is becoming more urgent than ever that factory and office workers learn new jobs quickly. This makes the training problem an increasingly important one.

In teaching workers how to do a new job, particularly of the highly repetitive type, it has occurred to some of us that perhaps certain movements or subdivisions of the cycle were more difficult to learn than others, or that with practice all of the movements were not affected in the same way. It has been suggested that perhaps the time required to perform certain hand motions, for example, decreased with practice at a much more rapid rate than others.

OBJECT

The object of this investigation was to study the effect of practice on the elements (therbligs and combinations of therbligs) used in an ordinary screwdriver operation, that of assembling a $\frac{5}{16}$ inch screw in a metal plate.

The operation used in this study consisted of driving a $\frac{5}{16}$-inch screw down until the bottom of the slot in the end of the screw came flush with the top of the metal bar into which the screw was driven, returning the screwdriver to a pre-positioning holder, indexing the metal bar so that the screw could be

driven back, grasping the screwdriver, and carrying it to the screw; and then repeating the operation.

PART USED

The part used consisted of a $\frac{5}{16}$-inch screw fitted into a tapped hole in a metal bar or screw holder as shown in Figs. 1 and 2.

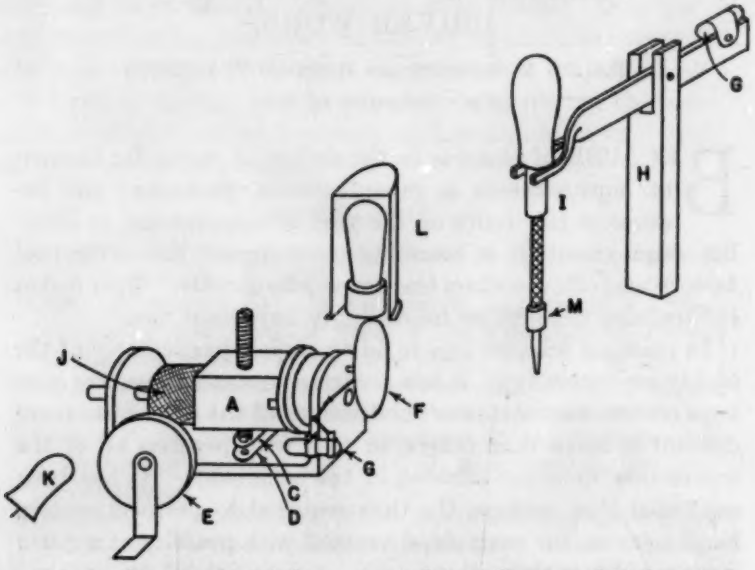

FIG. 1. Layout of workplace. A, steel bar; B, screw slotted on both ends; C and D, contacts under screw; E, photoelectric cell; F, push button; G, mercury switch; H, screwdriver holder; I, spiral ratchet screwdriver; J, knurled part of steel bar; K, contact cover for thumb; L, light source; M, knurled part of screwdriver.

EQUIPMENT USED IN MAKING THE STUDY

The apparatus consisted of a steel bar with a $\frac{5}{16}$-inch tapped hole, a spiral ratchet screwdriver, and a screwdriver holder. The bar A (Fig.1) was a one-inch square steel block 3 inches long and knurled on one end. The bar was mounted on a base and pivoted so that when the push button F (Fig. 1, was shoved in by the right hand, the bar could be turned by the

left hand by grasping it at J. The bar contained a $\frac{5}{16}$-inch tapped hole extending from the top to the bottom. Into this hole fit a case hardened screw B slotted on both ends. Beneath the screw were mounted two contacts C and D.

The screwdriver used was of the self-return ratchet type con-

FIG. 2. Workplace.

taining a screwdriver bit 3/16-inch wide and 1/32-inch thick, so that it would fit loosely into the screw slot which was 9/32-inch long and $\frac{1}{16}$-inch wide. When the screwdriver was placed upon the holder H, it tipped the mercury switch G which in turn was connected to a solenoid-operated pencil on the kymograph (see Figs. 3 and 4). The kymograph contained a strip

of paper moving at a uniform velocity of 31.9 inches per second beneath the solenoid-operated pencils. A movement of the pencils caused a jog on the paper (see Figs. 3 and 4) and indicated the time for the various therbligs used in the cycle. Time measurements were made in thousandths of a second.

The operator started the cycle by taking the screwdriver

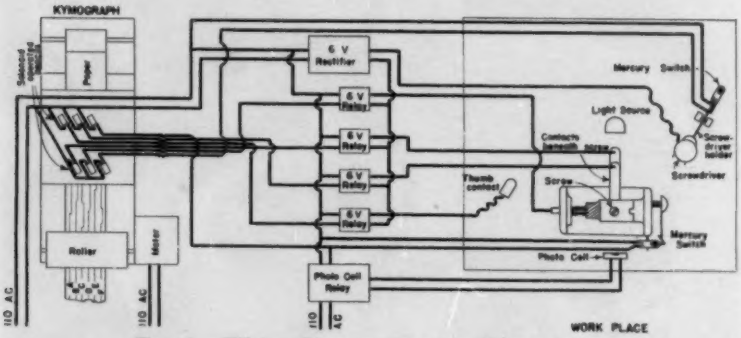

FIG. 3. Wiring diagram for screwdriver study.

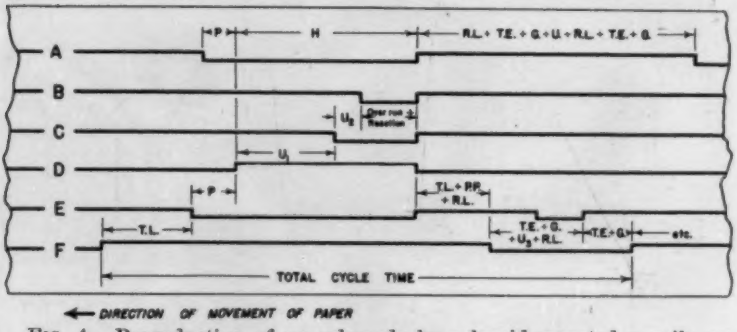

FIG. 4. Reproduction of record made by solenoid-operated pencils on kymograph.

from the holder and carrying (transport loaded) it to the screw. At the instant that the screwdriver was taken from the holder, the mercury switch was tipped and a solenoid-operated pencil made a jog in line F (Fig. 4).

A light source L (Fig. 1) was fixed so that a wide beam of light passed the screw and fell on a photoelectric cell E (Fig. 1) mounted rigidly in front of the screw. A metal shield (see Fig. 2) was placed in front of the photoelectric cell and a slot was cut in it $\frac{1}{8}$-inch wide by $\frac{3}{4}$-inch long. The long part of the slot was in a vertical direction (see Fig. 2), and so adjusted that whenever the screwdriver was in a vertical position, with the bit not more than $\frac{1}{4}$ inch above the screw, it interrupted the beam of light. As the screwdriver was carried to the screw, it interrupted the beam of light and caused the current to pass through a sensitive photoelectric cell relay (see Fig. 3). This current caused a solenoid-operated pencil to move and produced a jog in line E (Fig. 4) which marked the end of the transport. Thus T.L. between lines F and E of Fig. 4 is the length of time for transport loaded.

When the screwdriver contacted the screw, a 6-volt circuit was closed and the solenoid-operated pencil produced a jog in line D (Fig. 4).

The left hand, upon the thumb of which was worn a contact K, grasped the screwdriver at M (Fig. 1) and aided the right hand in positioning it. When the left thumb contact touched the screwdriver, a 6-volt current passed through a relay (see Fig. 4) and a solenoid-operated pencil produced a jog in line A (Fig. 4). This jog marked the beginning of the positioning time for the left hand.

The jog in line D (Fig. 4), produced by touching the screwdriver on the screw, marked the end of both left and right hand positioning times. Thus P between lines E and D (Fig. 4) indicated the length of time required for the right hand to position the screwdriver, while P on line A (Fig. 4) was the length of time for the left hand to aid in positioning the screwdriver.

As long as the screwdriver was held in contact with the screw, no jogs appeared in line D (Fig. 4). If at any time, however, the screwdriver slipped out of the slot or broke contact in any way, a jog appeared in line D (Fig. 4).

The left hand continued to hold the screwdriver, while the right hand used it to drive the screw down. The operators were told to run the screw down until the bottom of the slot was flush with the top of the screw holder block. After the screw had been driven down $\frac{3}{8}$ inch by the operator, the upper contact was touched. This closed a circuit, passed a current through a relay (see Fig. 3), and a solenoid-operated pencil produced a jog in line C (Fig. 4). Thus U_1 between lines D and C of Fig. 4 was the length of time required to screw (use_1) the screw down $\frac{3}{8}$ inch.

It was thought that more skill might be involved in driving the screw down the last $\frac{1}{8}$ inch than in the first $\frac{3}{8}$ inch, so that another contact was placed $\frac{1}{8}$ inch below the upper contact. When the screw was driven down by the operator until it touched the lower contact, a current was passed through a relay (see Fig. 3), and a solenoid-operated pencil produced a jog in line B (Fig. 4). This jog marked the end of the second screwdriver time (use_2), so that U_2 between lines C and B was the length of time required for use_2.

The lower contact was adjusted so that the screw would touch it when the bottom of the slot was still 1/64 inch above the block. At the moment that the operator visualized the fact that the screw was flush with the block, it was necessary that his hand and eyes be coordinated, and that he overcome any of the inertia effect of forcing the screwdriver downward. When the screwdriver was disengaged from the slot, the circuit was broken, and a jog appeared in line B (Fig. 4). The distance from the first to the second jog on line B was the time marked as "overrun + reaction."

At about the same time that the screwdriver was taken from the screw, the left hand released the screwdriver, breaking the circuit and causing a jog in line A (Fig. 4). This jog marked the end of the time which the left hand had been holding (hold) the screwdriver.

The left hand then moved to (transport empty) the knurled

part of the screw holder, grasped (grasp) it, used it, as soon as the push button was in, to turn over the block (use), released the block (release load), moved back (transport empty) to the screwdriver, and grasped (grasp) the screwdriver for the next cycle. The total length of these movements was designated by R.L. + T.E. + G + U + R.L. + T.E. + G on line A of Fig. 4. It was impossible to decrease the number of therbligs in this group, because of the type of circuit used for the work place.

After taking the screwdriver from the screw, the right hand carried it (transport loaded) to the holder, placed it (prepositioned) on the holder, and released (release load) it. As soon as the screwdriver was released on the holder, a solenoid-operated pencil made a jog in line F (Fig. 4). This jog indicated the end of the transporting, prepositioning, and releasing of the screwdriver, so that T.L. + P.P. + R.L. between D and E of Fig. 4 was the time required for these movements.

The right hand moved to (transport empty) the push button, grasped (grasp) it, pushed (use_3) it in, and then released it (release load). When the push button was shoved in, a mercury switch was tipped, and a solenoid-operated pencil made a jog in line E (Fig. 4) as long as the button was in. When released, the push button was returned to its original position by means of a spring and another jog appeared in line E (Fig. 4). Therefore, T.E. + G. + U_3 + R.L. between lines E and F (Fig. 4) was the time required to move to the push button, grasp it, push it in, and release it.

The right hand returned to (transport empty) the screwdriver and grasped it from the holder to start a new cycle. When the screwdriver was taken from the holder a jog appeared in line F (Fig. 4) ending the cycle. Thus T.E. + G. between lines E and F measured the time required to move back to the prepositioned screwdriver and grasp it.

The sequence of therbligs used for one cycle of the operation was as follows:

LEFT HAND

Steps used	*Name of therblig*	*Time for therblig on Fig. 4*
1. Position screwdriver	Position	P
2. Hold screwdriver	Hold	H
3. Release screwdriver	Release load	R.L. + T.E. + G. + U. + R.L. + T.E. + G.
Move to screw holder	Transport empty	
Grasp screw holder	Grasp	
Turn over the holder	Use	R.L. + T.E. + G. + U. + R.L. + T.E. + G.
Release the screw holder	Release load	
Move back to the screwdriver	Transport empty	
Grasp the screwdriver	Grasp	

RIGHT HAND

Steps used	*Name of therblig*	*Time for therblig on Fig. 4*
1. Carry screwdriver to screw	Transport loaded	T.L.
2. Position screwdriver in slot	Position	P.
3. Use screwdriver for $\frac{3}{8}$ inch of screw	Use_1	U_1
4. Use screwdriver for $\frac{1}{2}$ inch of screw	Use_2	U_2
5. Overrun + hand and eye coordination + visual reaction		Overrun + reaction
6. Carry screwdriver to holder	Transport loaded	T.L. + P.P. + R.L.
Place on holder	Pre-position	
Release screwdriver	Release load	
7. Move to push button	Transport empty	T.E. + G. + U_3 + R.L.
Grasp push button	Grasp	
Shove in on button	Use_3	
Release button	Release load	
8. Move back to screwdriver	Transport empty	T.E. + G.
Grasp screwdriver	Grasp	

PROCEDURE

Five male operators were used for this study. The operators worked five consecutive days, Monday through Friday, each week. They performed 200 cycles of the operation each day, and the time required for the 200 cycles was recorded.

At the beginning of the study each operator was shown how to do the operation in the correct manner. Each was admon-

TABLE I

ELEMENTS	TIME	Run Number 1	1A	3	5	7	10	13	17
		Number of Cycles of Practice 50	200	600	1000	1400	2000	2600	3400
T. L. (R.H.)	In 1000ths of a Sec.	414	434	452	419	423	395	378	353
	In % of Original	100	105	109	101	102	95	91	85
P. (R.H.)	In 1000ths of a Sec.	445	385	309	294	250	268	229	214
	In % of Original	100	87	69	66	56	60	51	48
U_1 (R.H.)	In 1000ths of a Sec.	3637	2944	2786	2932	2526	2364	2338	2184
	In % of Original	100	81	77	81	70	65	64	60
U_2 (R.H.)	In 1000ths of a Sec.	805	655	468	384	419	340	345	273
	In % of Original	100	81	58	48	52	42	43	34
Overrun + Reaction (R.H.)	In 1000ths of a Sec.	416	384	358	292	302	240	207	248
	In % of Original	100	93	86	70	73	58	50	60
T.L.+P.P.+R.L. (R.H.)	In 1000ths of a Sec.	672	651	513	476	400	384	314	319
	In % of Original	100	97	76	71	60	57	47	48
T.E.+G.+U_3+R.L. (R.H.)	In 1000ths of a Sec.	748	675	594	588	530	444	497	457
	In % of Original	100	90	79	79	71	59	67	61
T.E.+G.(R.H.)	In 1000ths of a Sec.	697	666	450	454	467	514	459	425
	In % of Original	100	96	65	65	67	74	66	61
P. (L.H.)	In 1000ths of a Sec.	373	324	289	243	245	202	189	166
	In % of Original	100	87	76	65	66	54	51	45
H. (L.H.)	In 1000ths of a Sec.	4826	3953	3497	3513	3026	2904	2842	2587
	In % of Original	100	82	73	73	63	60	59	54
R.L.+T.E.+G.+U_1+ R.L.+T.E.+G. (L.H.)	In 1000ths of a Sec.	2664	2527	2243	2038	1929	1867	1772	1715
	In % of Original	100	95	84	77	72	70	67	64
Total Cycle Time	In 1000ths of a Sec.	7834	6795	5893	5839	5162	4948	4767	4474
	In % of Original	100	87	75	75	66	63	61	57

ished that unless he was careful the screwdriver might slip out of the slot. Each was shown how any such slippage was recorded on the kymograph.

When the operators had completed 50 cycles on the first day of practice, a kymograph record (No. 1) was taken. At the end of the next 150 cycles, another kymograph record (No. 1a) was taken. A record of 25 cycles was taken each time on the kymograph. Twenty of the twenty-five cycles were analyzed.

Kymograph records were taken at the end of 200 cycles practice on the 1st, 3rd, 5th, 7th, 10th, 13th, and 17th day of practice. The kymograph records were numbered the same as the number of the day of practice, *i.e.*, run No. 10 was taken at the end of the 10th day of practice.

The operators were not informed as to the amount of time required by the other operators to perform the same day's task, but did have access to their own scores. They were told to work as accurately as possible and to make sure that the slot in the screw was flush with the block each time.

RESULTS

Table I shows the average time required by five operators to perform each of the elements after the various amounts of practice. These data are shown graphically in Figure 5.

The number of times that the screwdriver slipped from the slot or broke contact is given in Table II below.

As the operators became more proficient at the task, the number of times that the screwdriver slipped from the slot was greatly reduced. This points to the fact that the operators developed a certain muscular control involved in holding the screwdriver in the correct position.

CONCLUSIONS

The averages of the data for the five operators enable us to draw the following conclusions:

1. The average total cycle time for the group decreased rapidly until the third run after which it tended to level off slightly and then continue to decrease. The amount of de-

TABLE II

Number of Times the Screwdriver Slipped out of the Slot during Each Run of 20 Cycles

Operator	Run No.							
	1	1A	3	5	7	10	13	17
	Cycles previous practice							
	50	200	600	1000	1400	2000	2600	3400
A	23	15	10	7	4	10	0	1
B	24	5	10	5	0	0	0	2
C	15	5	11	1	5	—	0	5
D	26	20	20	4	—	18	10	0
E	5	14	0	2	0	11	0	8

crease in the total cycle time between the first and last runs for the group was 43 per cent.

2. The greatest decrease in right and left hand positioning times took place during the first four or five runs, after which the curve flattened off somewhat. The amount of decrease in the times for the left hand position for the group was 55 per cent, while for the right hand position it was 52 per cent.

3. The transport loaded times (right hand) increased to and including the third run and then decreased somewhat after the third run. The values fluctuated a considerable amount. The amount of decrease in the transport loaded times between the first and last runs for the group was 15 per cent.

4. The times required for use_1 and use_2 decreased throughout the study, with the greatest decrease coming during the first 3 runs. The amount of decrease in time between the first and last runs for the group for use_1 was 40 per cent, while for use_2 it was 66 per cent. This verified the belief that greater skill would be involved in driving the screw down the last $\frac{1}{8}$ inch than in the first $\frac{3}{8}$ inch. This also indicates that greater skill may be involved in operations requiring visually determined limits than in purely manual operations.

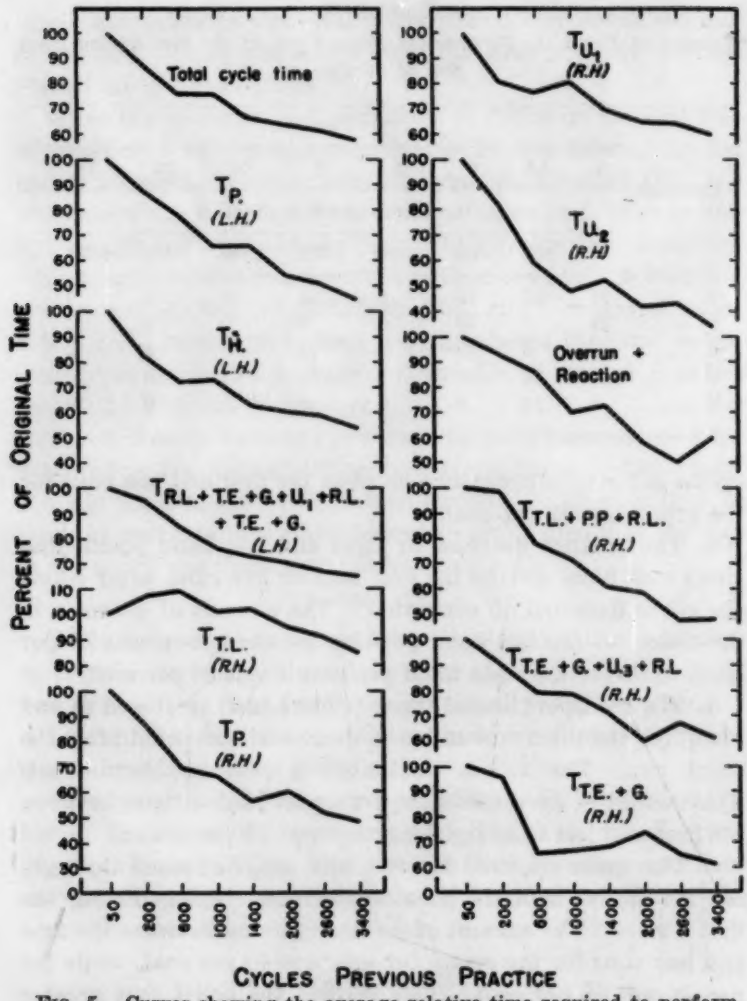
Total cycle time
T_{P_1} (L.H.)
T_H (L.H.)
$T_{R.L.} + T.E. + G. + U_1 + R.L. + T.E. + G.$ (L.H.)
$T_{T.L.}$ (R.H.)
T_{P_2} (R.H.)
T_{U_1} (R.H.)
T_{U_2} (R.H.)
Overrun + Reaction
$T_{T.L.} + P.P + R.L.$ (R.H.)
$T_{T.E.} + G. + U_3 + R.L.$ (R.H.)
$T_{T.E.} + G.$ (R.H.)
PERCENT OF ORIGINAL TIME
50 200 600 1000 1400 2000 2600 3400
CYCLES PREVIOUS PRACTICE

FIG. 5. Curves showing the average relative time required to perform each of the various elements. Average of five operators.

5. The average values of time for overrun + reaction decreased during the first thirteen runs and increased at the end of the study. The amount of decrease between the first and last runs for the group was 40 per cent.

6. The group of right hand therbligs, transport loaded, preposition, and release load decreased for the group until the thirteenth run, when it tended to level off. The amount of decrease between the first and last runs was 52 per cent. It is possible that the greatest decrease in time of the various therbligs of this group took place for preposition. This assumption was arrived at because of the slight reduction in time which took place in the previous transport loaded time.

7. The time required for the right hand transport empty, grasp push button, use_3 the push button, and release it decreased considerably until the tenth run, at which place the curve flattened off. The amount of decrease between the first and last runs for the group was 39 per cent.

8. The length of time required for transporting empty to the screwdriver and grasping it (R.H.) showed a decrease during the first three runs and then flattened off for the remainder of the runs. The amount of decrease between the first and last runs was 39 per cent.

9. The curves for left hand hold were much the same in shape as those for the left hand position and for the right hand use. The amount of decrease in time between the first and last runs for the group (left hand hold) was 46 per cent.

10. The average times required for the left hand to release screwdriver transport empty to the screw holder, grasp it, turn it over (use), release it, and transport empty, back to the screwdriver, and grasp it, reduced throughout the study. The amount of decrease between the first and last runs for the group was 36 per cent.

The conclusions given above indicate that the acquisition of skill had the greatest effect upon the times required for left and right hand position, use_2, and the group of therbligs transport loaded, preposition, and release load. The least change took place in the transport loaded time, and the remainder of the therbligs seemed to decrease about the same amount as the total cycle time.

A STUDY OF SOCIAL BACKGROUND AND MUSIC ABILITY OF SUPERIOR NEGRO CHILDREN

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INTRODUCTION

UNLIKE most inquiries of racial differences this study is concerned more with intra- rather than inter-racial difference in musical aptitudes. In reviewing the literature of this problem, one is indeed aware of the dearth of studies of musical aptitudes based on various levels of intelligence. Racial and national intelligence rest now on a fairly sound scientific basis. The progress of inter- and intra-racial studies in psychology must necessarily depend on the psychologist's attitude and his willingness to include the opinions, the theories, and the discoveries of sociology, anthropology and biology in his conclusion.

HISTORICAL SURVEY

The history of musical aptitudes and intelligence includes such names as Carl E. Seashore, pioneer, Dr. Leta S. Hollingworth for her monumental work on musical sensitivity of superior children, Dr. Andrew W. Brown for his validity and reliability studies of the Seashore tests, Dr. Thomas R. Garth for his studies on comparative racial tests, Dr. Jacob Kwalwasser for many improvements in musical aptitude tests, and Dr. Hazel M. Stanton for her cumulative predication in musical progress.

THE PURPOSE OF THE STUDY

The purpose of this study is to inquire into the musical apti-

tude of 100 superior children. It will be interesting and worthwhile to compare the musical aptitude of the hundred superior children with that of one hundred unselected children. Finally, the musical aptitude of the hundred intellectually superior children and the hundred unselected children will be compared with thirty children who were picked by their teachers as being superior in musical accomplishment.

No attempt has been made to separate these groups in reference to full-blood or mixed blood. After reading the literature on this phase it appears that such attempts too frequently yield unjustifiable results. Then too, a separation into groups based on color would be useless when we consider that at least three-fourths of the Negro population is mixed, according to the anthropologists Herskovits and Hooton.

The purpose of the study is also, to make certain other comparisons with the intellectually superior group, viz., a comparison of musical aptitude and age, and musical aptitude and previous musical instruction.

THE METHOD OF APPROACH

The three groups, the hundred intellectually superior, the hundred unselected children, and the thirty musically superior children, were given the Kwalwasser-Dykema music tests separately. The tests are on five double-disc Victor records. The directions for administering the tests were rigidly *adhered to*. The tests are tonal memory, quality discrimination, intensity discrimination, tonal movement, time discrimination, rhythm discrimination, pitch discrimination, melodic taste, pitch imagery, and rhythm imagery.

RESULTS

The intelligence of the three groups here was obtained by means of the New Stanford-Binet Form L.

The intelligence of the three groups is herewith presented. The mean IQ of the intellectually superior group was 127.2

TABLE 1

Group	Number	Mean IQ	SD	Range
Intellectually superior	100	127.2	12.6	120–162
Unselected	100	92.0	17.8	62–119
Musically superior	30	91.0	11.0	74–112

with a standard deviation of 12.6. The IQ range was from 120-162.

The mean IQ for the unselected group was 92 with a standard deviation of 17.8. The range for the hundred unselected pupils was 62 to 119.

The musically superior gets a mean IQ of 91. Their standard deviation was 11.0 and the range for this group was 74 to 112.

Hence, we see that both the unselected and the musically superior were low average as a group.

TABLE 2

Average Music Scores and Rank of 100 Intellectually Superior Pupils, 100 Unselected Pupils Picked at Random And 30 Musically Superior Pupils

Test	Superior pupils		Unselected pupils		Thirty musically superior pupils	
	Average score	Rank	Average score	Rank	Average score	Rank
Tonal memory	18.9	81	15.2	43	22.5	94
Quality discrimination	21.3	47	13.5	5	24.0	89
Intensity discrimination	22.5	46	18.0	8	24.5	81
Tonal movement	20.4	70	13.2	26	23.2	79
Time discrimination	19.0	71	16.2	41	25.0	100
Rhythm discrimination	19.6	80	15.7	23	23.0	100
Pitch discrimination	27.1	65	21.6	20	35.4	99
Melodic taste	15.8	71	11.2	25	21.0	100
Pitch imagery	16.2	75	14.7	43	21.0	96
Rhythm imagery	18.5	63	14.7	24	20.5	82
Total	19.9	....	15.4	....	24.3	....

Table 2 presents the average music scores of the three groups, with their respective ranks. The thirty pupils picked for their superior music abilities outrank the intellectually superior and unselected groups. It is also revealed that the intellectually superior pupils outrank the unselected group.

The highest average rank for the intellectually superior group was the eighty-first percentile. This was in tonal memory. This same group reached the eightieth percentile in rhythm discrimination. The intellectually superior group reached its lowest average rank in the intensity discrimination test. This was a rank of 46. The mean rank for the intellectually superior group was 56.9.

On the other hand the highest average rank for the unselected group was 43. This rank was obtained in tonal memory and pitch imagery. The lowest average rank for this group was in quality discrimination. This was an average rank of 5. The mean rank for the unselected group was 25.8. This group did not reach the 50 percentile in any average rank.

When we study the ranks of the musically superior we find an average rank of 100 three times. They are in time discrimination, rhythm discrimination, and melodic taste. The lowest average rank for this group was 79 which was in tonal movement. The mean rank for the musically superior group was 92.0; this is about the same as the mean IQ for this group. Close analysis of these data reveals that in the musically superior group the music scores on the test corroborate the opinions of the teachers.

As this study is chiefly concerned with music aptitudes of intellectually superior pupils our further comparisons will be limited to that group.

Is age an important factor in music aptitude scores? Let us see.

MUSIC ABILITY AND AGE

Table 3 presents the average music scores according to each age level. The age range was from 8 to 19. The youngest

TABLE 3

Average Music Scores According to Age of 100 Intellectually Superior Pupils

Age	No.	Tonal memory	Quality discrimination	Intensity discrimination	Tonal movement	Time discrimination	Rhythm discrimination	Pitch discrimination	Melodic taste	Pitch imagery	Rhythm imagery	Total	Average score
8	1	18.9	24.0	21.0	27.0	17.0	21.0	33.0	18.0	16.0	23.0	21.8	100
9	0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
10	3	20.2	16.2	22.2	15.2	20.1	19.2	23.1	16.0	14.0	14.1	18.0	78
11	3	21.0	15.1	23.0	20.2	19.1	20.4	26.2	14.4	7.9	13.4	18.7	78
12	12	17.2	21.4	22.1	18.4	18.1	19.3	27.2	14.4	16.0	20.0	19.4	74
13	16	19.7	23.0	23.4	21.7	19.7	21.9	26.9	16.9	19.9	20.4	21.3	96
14	18	17.6	21.6	23.6	21.0	18.4	18.8	28.3	15.2	15.6	18.7	19.8	82
15	10	18.1	24.0	23.4	17.1	15.2	19.2	24.2	14.4	17.1	16.2	18.9	48
16	11	18.4	23.5	21.4	20.2	18.1	19.1	26.4	16.3	18.5	18.1	20.0	79
17	9	20.3	23.1	24.0	23.3	21.2	20.1	31.2	16.2	19.3	20.3	21.9	94
18	7	17.1	20.1	22.0	21.1	21.1	17.1	28.1	17.0	16.0	20.0	19.9	27
19	10	20.4	22.2	22.2	19.4	21.1	20.1	24.3	15.4	18.4	19.3	20.2	79
Total	100	18.9	21.3	22.5	20.4	19.0	19.6	27.1	15.8	16.2	18.5	19.9	.....

TABLE 4

Average Music Scores of Intellectually Superior Pupils with No Previous Music Training and Also with Previous Music Training

	Tonal memory	Quality discrimination	Intensity discrimination	Tonal movement	Time discrimination	Rhythm discrimination	Pitch discrimination	Melodic taste	Pitch imagery	Rhythm imagery	Total score	Rank
With music instruction	18.3	22.7	23.8	20.4	22.0	19.8	33.9	18.4	19.4	19.6	21.8	98
No music instruction	18.6	22.1	22.6	20.6	18.8	20.5	26.1	17.2	16.1	18.5	18.3	88
Both	18.4	22.4	23.2	20.5	20.4	20.1	30.0	17.8	17.7	19.0	20.0	93

child was 8 years, 6 months and the oldest 19 years and 3 months.

Three per cent of the pupils were at age level 10 and 11 each. Both age levels rank at the 78 percentile.

We find 12 per cent of the pupils at the highest age level.

Finally there are ten per cent at the highest age level, age 19. They received a percentile rank of 79. Age was not an important factor in these tests.

MUSIC INSTRUCTIONS VS. NO INSTRUCTIONS

It will be interesting to compare the average scores of pupils who have had music instruction with those who have had no training at all. Pupils were required to state what musical instrument or instruments they played. They were also requested to tell the number of years of instruction they had in each instrument. Of course, a large number of these pupils had not received any instruction in music instruments.

Table 4 presents two groups, the one having had music instruction and the other without music instruction. It appears that previous instruction does not necessarily raise music scores in tonal memory, quality discrimination, and tonal movement.

The greatest difference between the two groups was in pitch discrimination. The group with music instruction received a score of 33.9 while the group with no previous instruction received a score of 26.1. Both groups made their highest scores in pitch discrimination. The lowest score made by the group with no instruction was 16.1 in pitch imagery. The rank for the instructed group was 88. The lowest score made by the instructed group was 18.3, and that was in tonal memory.

SUMMARY

The teachers' opinions of musically superior children corroborate test results. The musically superior picked by the teachers outrank the intellectually superior. Intelligence was not an important factor in making high musical aptitude scores. Age as a factor was only slight.

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COMPARISON OF THE OCCUPATIONAL RANKING AND INTERESTS, EDUCATION AND INTELLIGENCE OF PATIENTS AT SUNNYSIDE SANATORIUM[1]

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INTRODUCTION

BASIC to the psychological program of any sanatorium for the cure of tuberculosis is an analysis of its patient personnel. Especially is this true in a public sanatorium where it might be assumed that the socio-economic level of its patients is lower than the general average. Sunnyside Sanatorium, as does every public institution of its type, has the problem of apparently arrested cases in which the patient (cured) is released, then unable to stand the competition of extra-mural living, returns for further institutional treatment. It is estimated that about one in five of the population of Sunnyside are repeaters. A casual inspection of the patient's personal records shows a low socio-economic status and low education in both new and returned patients. It is evident, also, from the patients' listed occupations that few can expect to return to earning a living at their former occupation.

The rehabilitation program is concerned with the task of raising the standard of living which usually directly ties up with occupation and education and indirectly with emotional adjustment. To the psychologist, it is important to discover to what extent tubercular patients in sanatoria compare with those outside with respect to occupational status, interests, educational achievement, and intelligence. Therefore, comparative relationships, of education, intelligence, occupational

[1] Publications, Indiana University Psychological Clinic, Ser. II, No. 28.

interests of men and women patients at Sunnyside Sanatorium, Indianapolis, Indiana, are pertinent to this study undertaken during the academic year 1939–40.

EDUCATION

Table 1 indicates the formal education distribution of 104 men and 131 women; also the number and per cent at each level who terminated their formal education. An inspection of this table indicates that approximately 45 per cent of the men have gone no farther than the eighth grade. Forty per cent more got no farther than high school, while a small proportion, six per cent, have gone to college or attended business school beyond the high school. The women have about the

TABLE 1

Educational Distribution of Patients at Sunnyside

Formal education (institution)	Years	Men		Women	
		No.	%	No.	%
Grade school	None	2	1.92	2	1.53
	Pre-school	2	1.92	2	1.53
	1	1	0.96	2	1.53
	2	0	0.00	0	0.00
	3	1	0.96	0	0.00
	4	2	1.92	4	3.05
	5	2	1.92	3	2.29
	6	3	2.88	4	3.05
	7	4	3.85	5	3.82
	8	27	25.96	29	22.14
High school	9	9	8.65	17	12.98
	10	11	10.58	17	12.98
	11	8	7.70	12	9.15
	12	25	24.04	25	19.10
College, business, or trade school	13	6	5.77	2	1.53
	14	0	0.00	4	3.05
	15	0	0.00	3	2.29
	16	1	0.96	0	0.00
Totals	.....	104	100.00	131	100.00

same ratio as the men. The average number of years spent in school is ten for both groups which is approximately equivalent to second year of high school standing.

INTELLIGENCE AND EDUCATION

Table 2 indicates by sex the average years in school and the coefficients of correlation between each test and years spent in school. The differences among the significant measures are slight and probably not statistically significant. The satisfactory correlations of over .70 would indicate that there is a fairly high relationship between ability to get schooling as revealed by the Pressey tests and number of years spent in school. Evidently men and women are similar in educational background, and as a group fairly well educated; individual educational programs, however, would take cognizance of individual differences with respect to education in both the high school and below high school groups.

TABLE 2

Correlation between Years of Formal Education and Test Scores

	No.	Av. score	Stand. Dev.	Av. years in school	Coeff. Correl.
			Men		
Pressey Class.	83	55	20.15	10	.791
Pressey Verif.	77	57	18.29	10	.779
			Women		
Pressey Class.	87	51	19.85	10	.769
Pressey Verif.	89	55	18.41	10	.741

VOCATIONAL BACKGROUND AND OCCUPATIONAL INTELLIGENCE

What is the occupational and vocational background of Sunnyside population and how do they compare with the general population on occupational intelligence?

In order to answer this question it seemed desirable to list the occupations of men and women and then endeavor to com-

pare the occupational level with that of the general population by the use of a scientifically constructed rating scale. The

TABLE 3

Kinds and Frequencies of the Occupations of Men, Sunnyside Sanatorium, According to the Barr Rating Scale

Occupation	Frequency	Barr
Advertising	1	16.00
Landscape gardener	1	12.96
Newspaper	1	12.84
Musician	1	12.70
Optician	1	12.06
Concessionaire	1	11.51
Clerical and accounting	13	11.39
Meter reader	1	11.34
Machinist (skilled metal)	5	10.26
Skilled factory inspector	8	10.00
Pressman (printer)	1	10.00
Golf, professional	2	9.75
Sales	6	9.72
Pool room operator	1	9.72
Tailor	1	9.54
Electrician	1	8.99
Mail carrier	1	8.49
Meat cutter	1	7.79
Building trades	2	7.71
Molder	2	7.70
Farmer	1	7.24
Mechanic (auto, etc.)	6	7.05
Barber	1	6.92
Shoe repair	1	6.85
Filling station hand	3	6.75
Warehouseman	2	5.87
Truck driver	7	5.81
Waiter, bell boy, etc.	2	5.27
Elevator operator	2	3.66
Janitor and porter	2	3.62
Laborer	10	3.62
W.P.A.	4	3.62

Barr scale of occupational intelligence was chosen.[2] On this scale each occupation is assigned an arbitrary rating according to the intelligence judged necessary in that occupation.

Table 3 lists the occupations of the Sunnyside men with the Barr rating which corresponds to that occupation. The occupations show a wide variety and range from W.P.A., rated three and above by Barr, to opticians, newspaper work and advertising, which are rated twelve and sixteen on the Barr scale. Certainly this sanatorium draws to it men from widely differing occupations and occupational abilities; an important factor certainly for individual education and rehabilitation programs.

Table 4 shows a comparison of the Sunnyside group with the general population referred to in Terman's study.

TABLE 4

Barr Scale Ratings of Adult Males of General Population and Male Patients at Sunnyside Sanatorium

	Adult males of general population		Male patients at Sunnyside
	Method A*	Method B*	
Number	250,519	320,283	92
Average	8.88	7.92	7.97
S.D.	3.24	3.38	3.15
Range	3–16.90	3–16.90	3.92–16.91

* This represents two methods used by Authors of "Genetic Studies of Genius" in rating unemployed. Method A simply ignores them, assuming that they would fall in the same groups as the general population. In Method B they are added (69,764 of them) to the total and given an arbitrary rating of 4.00. Method A was followed in Sunnyside statistics; patients with no listed occupations were ignored in this study.

In Table 4 are the totals for the adult males on Method A and B described by Terman, with their averages and standard deviations. With them are compared the 92 Sunnyside men, their averages, spread and standard deviations.

[2] For a description of the Barr scale and explanation of Methods A and B the reader is referred to Terman, Lewis M., *Genetic Studies of Genius*, Stanford University Press, 1926, I, 66–79.

The average occupational rating of Sunnyside men is 7.97 which compares closely with the general male population of 7.92 (baker, plasterer, metal finisher) according to Method B. According to Method A there is a somewhat larger difference between the general population and the Sunnyside group.

When the median occupational rating of the Sunnyside group is compared with the median occupational rating of the Terman A group it was found that the Sunnyside group only exceeded the median of the Terman A group by 43.39 per cent, comparing the averages and standard deviations of the two groups by standard formula, the critical ratio is nearly three in favor of the Terman group A which approaches a statistically reliable difference. Terman Method A group probably shows a truer comparison than Method B group and would indicate the Sunnyside group to be somewhat lower in economic status.

The measures, standard deviation, average and range, when compared with the Terman Group B show slight differences that are not statistically significant. It is likely then, that the Sunnyside group is somewhat below the general population in occupational level according to Terman's study, though the difference is not great. This might indicate, for a large number of patients, the impossibility of continuing their former occupations; therefore the necessity of preparing for some other less strenuous work, which in the nature of their high test performance could be supplied with profit by individual education.

With reference to the Sunnyside women, it was more difficult to make comparison, since the Barr scale deals only with the occupational rankings of men.

Table 5 gives the approximate Barr rating together with the name of the occupation and frequency for women. The women at Sunnyside for the most part have no gainful occupation. Fifty-seven per cent list their occupations as housewives or students. Eleven per cent list their occupations as "housework." A personal investigation reveals that this group is

TABLE 5

Kinds and Frequencies of the Occupations of Women, Sunnyside Sanatorium, According to the Barr Rating Scale

Occupation	Frequency	Barr
Graduate nurse	3	12.06
Stenographer	8	11.78
Bookkeeper	2	11.34
Office work	2	11.34
Inspector	2	10.00
Saleswoman	1	9.72
Clerk, grocery	1	9.72
Clerk	3	9.72
Milliner	1	9.72
Housewife	2	9.72
Factory worker	1	8.50
Cook	1	7.19
Factory work	1	7.05
Machine operator	1	7.05
Matron	1	6.00
Waitress	7	5.27
Presser	1	4.98
Laundress	1	4.98
P.W.A (bookbinder)	1	3.62
Elevator	1	3.62

made up mostly of unmarried women who help with housework at home or keep house for relatives. Thirty-two per cent list occupations which are given approximate ratings on the Barr scale for male occupations. The average of the thirty-two per cent was 8.77, which is somewhat higher than the average of the men and places them at the level of skilled workers in spite of a fairly high concentration in the stenographic, clerical and nursing groups which are above average. These are merely approximations, however, and the numbers are too few and the data too meager to be accurate. However, we can asume from other measures that the women in Sunnyside approximate closely the average of the general population.

INTELLIGENCE AND OCCUPATIONAL PREFERENCE

Table 6 gives the coefficient of correlation of 79 men and 94 women between the average scores of the Pressey Classification and Verification Tests and the Occupational Interests score in each of the seven fields of occupation of the Kuder Preference Record. The coefficients of correlation are low and in some instances negative. Evidently there is little relationship between occupational interests and intelligence. Perhaps the amount of interest shown is compensatory mechanism and represents wishful thinking on the part of the patient.

TABLE 6

Correlations and Intercorrelations between the Average Scores on the Pressey Tests and Occupational Interest Scores on the Seven Fields of Occupational Interests of the Kuder Test

MEN'S GROUP

	2. Sci.	3. Comp.	4. Mus.	5. Art	6. Lit.	7. So. Ser.	8. Per.
1. Pressey	−.14	−.208	−.004	−.124	+.232	−.104	+.095
tests 2. Sci.		−.530	+.107	+.127	+.409	+.496	−.154
3. Comp.			+.145	−.220	−.117	+.105	+.145
4. Mus.				−.118	+.291	−.125	−.217
5. Art					−.159	−.225	−.239
6. Lit.						+.137	+.021
Number 79						7. So. Ser.	+.321

WOMEN'S GROUP

	2. Sci.	3. Comp.	4. Mus.	5. Art	6. Lit.	7. So. Ser.	8. Per.
1. Pressey	+.302	−.008	+.004	+.054	+.489	+.239	−.113
tests 2. Sci.		−.200	+.029	+.173	+.087	+.232	+.021
3. Comp.			+.029	+.025	+.089	+.141	+.167
4. Mus.				+.004	+.033	+.015	+.060
5. Art					+.058	+.109	+.058
6. Lit.						+.345	+.173
Number 94						7. So. Ser.	+.486

Sci.—Science
Comp.—Computation
Mus.—Music
Lit.—Literature
So. Ser.—Social Service
Per.—Persuasion

CONCLUSIONS

1. There seems to be a significant relationship between the intelligence and number of years spent in school. The Sunnyside population evidently has on the average a second year high school education.

2. Sunnyside Sanatorium attracts to it men from widely differing vocational backgrounds and occupational abilities.

3. The occupational level of the Sunnyside patients seems to be slightly lower than the occupational level of the general population as revealed by the Barr scale. This would indicate a rather low standard of living and too strenuous work which would have a bearing on the recurrence of tuberculosis with reference to repeaters.

4. The fact that there is a satisfactory correlation between intelligence and schooling and a relationship between intelligence and occupational level would indicate that individual education would be a factor toward improved economic status.

5. Part of the remedy would be the psychological improvement of the patient's emotional attitudes through education which would raise his economic level.

6. There seems to be little relationship between the amount of interest shown by patients as judged by the Occupational Preference Record and intelligence.

7. The findings of this paper indicate that the Sunnyside population represent a normal sampling of the population in spite of the disease of tuberculosis.

INFLUENCE OF SIZE OF TYPE ON EYE MOVEMENTS[1]

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IN our investigations of typographical factors influencing speed of reading, we have found that size of type decreases reading efficiency if unusually large or small sizes are compared with 10 point as a standard.[2] In general, type sizes between the limits of 9 point and 12 point can be read equally fast. Beyond 12 point and below 9 point speed of reading is retarded.

We have undertaken two eye-movement studies to determine the specific patterns of eye movements involved in reading an unusually large size of type (14 point) and a very small size of type (6 point) in comparison with a medium size of type (10 point). The eye movements were photographed by the Minnesota eye-movement camera.

In the first study, each of 20 college students read 10 paragraphs from the Chapman-Cook Speed of Reading Test, Form A, set in 10 point type and 10 different paragraphs from Form B, of the same test set in 6 point type. In the second study, each of 20 additional college students read 10 paragraphs from Form A set in 10 point type and 10 paragraphs from Form B set in 14 point type.

10 POINT VERSUS 6 POINT

The results for the first study (10 point versus 6 point) are shown in Table 1.

[1] The writers are grateful to the University of Minnesota Graduate School for research grant to finance this study.

[2] D. G. Paterson and M. A. Tinker, *How to Make Type Readable*, New York: Harper and Brothers, 1940. (Size of Type, 29–37.)

TABLE 1

Mean Eye-Movement Measures in Reading 10 Point Type and 6 Point Type

Note: Pause duration and perception time are reported in seconds. Ten paragraphs from the Chapman-Cook Speed of Reading Test, Form A, were set in 10 point type and 10 paragraphs from Form B of the same test were set in 6 point type. All paragraphs were printed as follows: Scotch Roman, lower case, 19 pica line width, set solid, on egg-shell paper stock.

Type size	Fixation frequency	Words per fixation	Pause duration	Perception time	Regression frequency
10 point	167.7	1.9	0.23	38.1	16.8
6 point	180.1	1.7	0.24	43.7	18.6
Differences*	+12.4	− 0.2	+0.01	+ 5.6	+ 1.8
Per cent Diff.	+ 7.4	−10.5	+7.20	+14.7	+11.0

* All differences are statistically significant (t values beyond the 1 per cent level) except for regression frequency in which case the t value is between the 5 and 10 per cent levels. Differences were derived from original computations carried to four decimal places.

It is obvious that all eye-movement measures show that 10 point type is read more efficiently. Ten point type requires fewer fixations and therefore more words per fixation are read. Pause duration is also shorter and total perception time is appreciably less. Although regression frequency appears to be quite different (11 per cent difference) yet the statistical significance of the difference falls short of a satisfactory degree of probability.

We may characterize the oculomotor patterns in reading a small type size (6 point) by saying that the number of fixations is increased, the span of perception is decreased, the time per fixation is increased, total perception time is greatly increased and the frequency of regressive movements is slightly increased.

Word form is approximately the same for both sizes of type and the area covered by both kinds of printing is not greatly different. But we find a marked difference in visibility of

the printed characters. Use of the Luckiesh-Moss Visibility Meter shows a 30 per cent difference in favor of 10 point type. It appears, therefore, that 6 point type is nearer the threshold of visual discrimination.

10 POINT VERSUS 14 POINT

The results for the second study (10 point versus 14 point) are shown in Table 2.

TABLE 2

Mean Eye-Movement Measures in Reading 10 Point Type and 14 Point Type

Note: Pause duration and perception time are reported in seconds. Ten paragaphs from the Chapman-Cook Speed of Reading Test, Form A, were set in 10 point type and 10 paragraphs from Form B of the same test were set in 14 point type. All paragraphs were printed as follows: Scotch Roman, lower case, 19 pica line width, set solid, on egg-shell paper stock.

Type size	Fixation frequency	Words per fixation	Pause duration	Perception time	Regression frequency
10 point	152.4	2.1	0.23	34.7	17.5
14 point	184.5	1.7	0.21	39.4	19.7
Differences*	+ 32.1	− 0.4	−0.02	+ 4.7	+ 2.2
Per cent Diff.	+ 21.1	−19.1	−6.00	+13.6	+12.6

* All differences are statistically significant (t values beyond the 1 per cent level) except for regression frequency in which case the t value is between the 10 and 20 per cent levels. Differences were derived from original computations carried to four decimal places.

The results again show that 10 point type is read more efficiently than 14 point. The details of the eye-movement differences, however, are not the same as were found in the 10 point and 6 point comparison. Here a striking difference exists in frequency of fixations (21.1 per cent increase). This is reflected by a similar marked difference in words per fixation. It is interesting to note that the direction of the difference in pause duration is reversed. This time our readers spent less time per fixation in reading 14 point than in reading

10 point. The net result in terms of total perception time again favors 10 point type. There is a slight but statistically unreliable difference in favor of 10 point so far as number of regressions is concerned.

Our interpretation of the reduced efficiency with which 14 point type can be read is based primarily on area differences. Fourteen point type in comparison with 10 point requires 87 per cent more printing space. This means that there is a striking increase in the amount of *horizontal* space covered *per word* by the 14 point type. This forces the eye to make many more fixations in covering the same amount of reading material.

SUMMARY

1. In previous studies of reading performance a striking difference in favor of reading 10 point type as compared with 6 point type or with 14 point type was found.

2. Eye-movement photographs of two new groups of 20 subjects each disclose the specific changes in oculomotor patterns which take place in reading an excessively small size of type (6 point) and an unusually large size of type (14 point).

3. It appears that the decreased efficiency with which 6 point type is read is due to reduced visibility.

4. The factor responsible for reducing the efficiency with which 14 point type is read, seems to be due primarily to the increased amount of printing area that must be covered in reading a given amount of text.

CHILDREN'S WISHES

ROSE ZELIGS

Avondale School, Cincinnati, Ohio

THE wish is a useful instrument in the study of character, personality, maturity, tolerance, and knowledge. It may indicate social-mindedness, personal adjustment, and an individual's tendency to face reality or to live in a dream world. Washburn[1] studied the wishes of children as a means of measuring their adjustment.

The present report deals with the factors of most concern to 12-year-old children as expressed in their wishes; a comparison of the wishes expressed by 12-year-old children in 1935 with the wishes of children, of the same age and background, expressed in 1940; sex differences found in children's wishes; and a study of the most common wishes of 12-year-old children.

PROCEDURE

The subjects of this study were 160 sixth-grade boys and girls of the Avondale Public School, Cincinnati, Ohio. The average chronological age was 12 years and the average mental age, according to the Otis Group Intelligence Scale, Advanced Examination Form A, was 14 years and 9 months. The socio-economic background of the children was a little below "very high" on the Sims Score Card.

In June, 1940, the four upper groups of the six sixth grade classes of the Avondale School were asked to write what they would ask for if they could have their three best wishes come true. They were told that by giving their true feelings they

[1] J. N. Washburn, "An Experiment in Character Measurement," *Journal of Juvenile Research*, 1929, 13, 1–18.

would help their teacher in a special study. The same method was used in obtaining the wishes of the four sixth grade classes of the same school in 1935.[2] The data to be discussed will refer to the wishes expressed by the 1940 classes except when a comparison is made between the wishes of the two groups.

FACTORS OF MOST CONCERN TO CHILDREN

As shown in Table 1, the children's wishes show concern for social welfare; family welfare; personal possessions and pleasures; and personal welfare, which comprises educational factors, vocational factors, character and personality. This distribution of wishes suggests an awareness of social problems and growth towards social maturity.

TABLE 1

Percentage Distribution of Factors of Most Concern to Children, as Expressed by Their Wishes

Number	165	160	
Year	1935	1940	Difference
Social welfare	3	28	+25
Family welfare	5	23	+18
Family economy	5	9	+ 4
Personal possessions and pleasures	25	14	−11
Personal welfare:			
Educational	7	4	− 3
Vocational	13	5	− 8
Character and personality	42	17	−25
Total per cent	100	100	

The 12-year-old child is deeply concerned with present current events. He hears, reads, and talks about the news every day. He is deeply affected by the brutality of the dictators

[2] These subjects are described in: Rose Zeligs, "The Relationship of Emotional and Personality Traits to Learning in Children," *Abstracts Graduate Theses in Education*, Vol. III (Carter V. Good, L. A. Pechstein, Gordon Hendrickson, Editors), Cincinnati: Teachers College, University of Cincinnati, 1940, p. 224.

and the helplessness of their victims. He learns to appreciate his precious heritage of freedom and is fearful that he may lose it. This fear and the possibilities of war also make him more conscious of his family and the dangers that may involve it.

COMPARISON OF WISHES FOR 1935 AND 1940

A comparison of the sixth grade child's wishes today with those of the same grade child five years ago reflects this greater social mindedness. Table 1 shows that today the child is much more concerned with social and family welfare and is less interested in personal welfare. On the whole, however,

TABLE 2

Children's Wishes Concerning Social Welfare

A.	Political problems
	World peace
	America stay out of war
	Hitler be wiped out
	World unity
	All countries become democratic
	Naziism be crushed
	Allies win war
	U. S. have a good army
	Hitler not reach America
	Stalin should die
	Mussolini should die
	Roosevelt be elected
B.	Social problems
	All people be healthy
	All people be happy
	All people be fairly treated
	Grow to be useful to world
	Criminals come to their senses
	Serve humanity
	All people have a chance to work
	Family always be democratic
	Better homes built for poor people
	Be good citizen of the U. S.

TABLE 3

Children's Wishes Concerning Family Welfare

A.	Health
	Family be healthy
	Family live long
	Mother's health improve
	Father would get well
	Grandmother would get well
	Brother get rid of hay fever
	Sister get well
	Dead relatives come back to life
	Mother would be living
	Father would be living
B.	Brothers and sisters
	To have a big brother
	To have a little brother
	To have a little sister
	Brother could go to college
	Brothers become fine men
	Sister grow to be beautiful, kind woman
	Sister marry nice man
	Brother not go to war
C.	Happiness
	Family be happy
	Make parents happy
	European relatives come to U. S.
	Divorced parents unite
	No arguments in our home
	Father keep on with his good work

TABLE 4

Children's Wishes Concerning Family Economy

Family own a nice house
Family own a car
Father succeed in business
Parents not work so hard
Mother not work out
Family be wealthy
Mother have everything she wants
Father get a job
Family not in want
Father not deny himself for us

the wishes expressed in 1935 covered practically the same items as those listed in 1940.

Most of the children's wishes show an awareness of reality

TABLE 5

Children's Wishes for Possessions and Pleasures

A.	Possessions
	Have much money
	Have a million dollars
	Have money to pay bills
	Have a bigger allowance
	Own a car
	Have a bicycle
	Have bicycle accessories
	Have a home in the country
	Own an airplane
	Own a ranch
	Have my own room
	Have a large workshop
	Have a horse to ride
	Have a dog
	Have a Boy Scout tent
	Have photograph developing equipment
	Have $500.00 Reflex camera
	Have a camera
	Have books
	Have a typewriter
	Have a gun
	Have a free pass for all ball games
	Have a desk
	Have $100.00 to pick own clothes
B.	Pleasures
	Go to New York World's Fair
	Travel
	Go to Florida
	Go to camp
	Go to ball game every day
	See Reds win pennant
	Know all the Reds
	Go swimming
	Go to a circus

TABLE 6

Children's Wishes Concerning Personal Welfare

A.	Educational
	Succeed in school
	Pass in school
	Go to junior high school
	Go to college
	Be through with college
	Go to summer school
	Go through aviation school
	To know everything
B.	Vocational
	Success in business
	Become a Reds ball player
	Be a poet
	Be a great scientist
	Be baseball and football player
	Be great chemist
	Pick a good profession
	Be manager of baseball team
	Be successful dentist
	Be civil engineer
	Be good doctor
	Be good lawyer
	Be good violinist
	Work in radio station
	Be opera star
	Be school teacher
	Be nurse
	Be movie star
	Be good athlete
C.	Character and personality
	Be like my father
	Be Eagle Scout
	Be healthy
	Be popular
	Be a decent man
	Be an honest man
	Be handsome
	Be smartest in class
	Be strong

Be better natured
Grow tall
Have wisdom
Be good dancer
Succeed in life
Be friend of teacher
Be good wife
Break bad habits
Be good to everyone
Follow parents' example
Be better boy
Help father and mother
Get a job
Win cups at camp
Have more girl friends
Have boy friend
Be happy

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and effort to adjust to it. Not very many 12-year-old children are building castles in the air that are totally impossible to reach, though a number of them have aspirations that are difficult to attain.

SUMMARY

Although this study is based on a small number of cases the data suggest that:

1. Twelve-year-old children today are much more concerned with social welfare, political conditions, and family welfare than were children of the same age and school five years ago. The latter were more concerned with personal development, possessions and pleasures.

2. The boys are more interested in personal development, social welfare, political progress, and possessions and pleasures, while the girls surpass the boys in wishes pertaining to family welfare.

3. The 35 most common wishes comprise 68 per cent of all the wishes listed. These include the desire for world peace, health, long life, family happiness, success in school, passing in school, success in business for father, that America stay out

TABLE 7

Children's Most Common Wishes

	Boys	Girls	Total
1. World peace	26	21	47
2. Family be healthy	20	21	41
3. To succeed in school	12	12	24
4. Family be happy	12	9	21
5. Family live long	12	8	20
6. Father succeed in business	10	10	20
7. To pass in school	4	12	16
8. To have a bicycle	8	7	15
9. Family own a house	6	8	14
10. America stay out of war	6	6	12
11. To get married	5	7	12
12. To be happy	1	11	12
13. Hitler be wiped out	9	1	10
14. Be healthy	5	5	10
15. Succeed in life	4	5	9
16. All people be healthy	5	3	8
17. Go to Junior High School	6	2	8
18. Go to World's Fair	6	1	7
19. Get autographed baseball equipment	6	0	6
20. All people be happy	2	4	6
21. Have much money	6	0	6
22. Grow tall	4	1	5
23. Family have a car	4	1	5
24. Succeed in business	5	0	5
25. Live long	5	0	5
26. Have children	2	3	5
27. Be popular	3	2	5
28. Brother not go to war	1	4	5
29. Have a car	4	1	5
30. World unity	3	2	5
31. Have a dog	2	2	4
32. To go to college	1	3	4
33. All countries become democracies	1	3	4
34. European relatives come to U. S.	2	2	4
35. Father would get well	2	2	4

of war, a house for the family, a bicycle, to get married, to be happy, healthy and successful, and that Hitler be wiped out.

4. Many of the most common wishes of the children are similar to their most common worries.[3]

The data suggest that normal 12-year-old American children are adjusting themselves to their social environment, are imbued with American ideals of peace and democracy, are well-informed about world affairs, and are looking ahead toward a future with the idea of vocational choice and marriage. However, individual differences are found among the children, some expressing selfish desires for things that show their immaturity while others show character and maturity.

The material of children's wishes might be developed into a test on the social-mindedness and social maturity of children.

NOTE 1. Wishes listed in May, 1941, by 100 eighth grade children of the same school, reflect the same trend as that expressed by the sixth grade children, but show a greater concentration of interest in educational and vocational achievements. This may be partly caused by their need to select their high school course of study at this time. The eighth grade distribution is:

	Per cent
Social welfare	14
Family welfare	9
Family economy	4
Personal possessions and pleasures	19
Personal welfare:	
Educational	18
Vocational	27
Character and personality	9
Total	100

NOTE 2. Twelve-year-old children from another suburb in Cincinnati, whose average mental age was 14 years and whose socio-economic background on the Sims Score Card was

[3] Rose Zeligs, "Children's Worries," *Sociology and Social Research*, XXIV, No. 1, September–October, 1939.

somewhat below that of the Avondale 12-year-old children studied, expressed few wishes for social welfare and more wishes for personal and family posssesions.

It seems probable that children of lower subsistence levels, especially those who do not always have bare necessities, would probably concentrate on economic security and family welfare in their wishes.

A NOTE ON THE TWENTY-MINUTE TIME LIMIT OF THE OTIS S–A TESTS WHEN USED WITH SUPERIOR HIGH SCHOOL STUDENTS*

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PROBLEM

IN the revised manual of directions for the use of the Otis Self-Administering Tests of Mental Ability, Higher Examination, one of the special features which is listed is the following: "*Flexible Time Limit.* Provision is made for administering the examinations with a time limit of either 20 or 30 minutes. The 20-minute time limit may be used for general survey purposes or with normal school and college students. The 30-minute time limit should be used when time allows, as it will give a more accurate measure." In another section of the manual a table is provided by means of which scores obtained using the 20-minute time limit "may be transmuted into terms of 30-minute time-limit scores in order that they may be compared with norms or other 30-minute scores."

Others (1, 2, 4) have found grounds for the belief that when superior high school seniors and older persons are tested it is preferable to use the 20 instead of the 30-minute time limit. Miles (4), using adult subjects, reported a reliability coefficient of .86 with the 30-minute time limit as contrasted to coefficients of .90 and .97 with the 20-minute limit. Hovland and Wonderlic (2) found that 40 per cent of their subjects (adults) finished in 30 minutes, 10 per cent in 20 minutes, and

* Study made under the supervision of Dr. Donald E. Super, Clark University.

concluded that as a whole the test is too easy for adults, superior high school students, and college students. They have accordingly revised the test into a 12-minute examination (3) which yields reliabilities from .85 to .94 by the split-half method, and from .83 to .92 when forms are intercorrelated.

From the above information, that contained in the manual and the findings of the researchers cited, it would seem that the use of the 20-minute time limit is not only defensible, but might even be considered a necessity with certain groups.

METHOD

In the school year of 1939–40 a battery of educational and psychological tests was administered to 117 students, hereinafter designated as group I. In 1940–41, 127 subjects, constituting group II, took the tests. All subjects were juniors and seniors in high school, selected from the same schools, by the same principals, on the same basis each year. Their mean ages were 16.62 years and 16.74 years, respectively, with sigmas of .83 and .85. With both groups, two scholastic aptitude or intelligence tests were administered, the American Council on Education Psychological Examination, 1938 edition, and the Otis Self-Administering Test of Mental Ability, Higher Examination, Form A. The conditions under which the ACE was administered were constant for the two groups, whereas the Otis was given under two different times. Group I took the test under a 30-minute time limit, while group II was under a 20-minute time limit. The table for transmuting the 20-minute time limit scores into terms of 30-minute time limit scores was used.

Upon examination of the scores on the Otis for the two groups it was observed that the scores ran consistently higher for group II than for group I. This might have been due, of course, to an actual difference in ability between the two groups. When the ACE scores were considered, however, it was found that there did not appear to be any considerable difference between the two groups. The ACE, having been administered under identical conditions both years, gave scores

which were directly comparable. These observations seemed striking enough to warrant statistical treatment. This treatment yielded the results in Table 1.

TABLE 1

	ACE		Otis	
	Group I	Group II	Group I	Group II
Mean raw score	83.59	88.19	53.18	59.42
Sigma	23.10	22.57	8.18	8.53
D/σd	1.57		5.87	

From the above table it may be seen that there is a tendency for group II to exceed group I on the ACE, but that the difference is not statistically significant. When the Otis is considered, however, it will be seen that the difference between the two groups is highly significant, there being less than one chance in a million that the difference is due to chance.

CONCLUSIONS

We may conclude from these results that the use of the 20-minute time limit with somewhat superior juniors and seniors in high school is not justified even for survey purposes if the scores are to be compared with 30-minute scores made by any other group of subjects. These conclusions are, of course, applicable only to subjects in this age range, generalizations to college students and adults not being justified.

An additional finding must be reported in fairness to the test. The correlations between the Otis and the ACE are approximately identical when the Otis is administered under the two time conditions. For group I the correlation is .75, while for group II it is .81. Thus the test may be used with a 20-minute time limit for research purposes such as the determination of the relative ability of two similarly tested groups, as it does place subjects in the same relative rank as the ACE with even slightly greater accuracy than does the 30-minute test.

The wide discrepancy found between the two groups on the Otis may perhaps be explained in the following way. The examinations were constructed in the orthodox manner, that is, the items were arranged in order of increasing difficulty. When the 30-minute limit is used, a considerable percentage of subjects, particularly adults, are able to complete the test in the allotted time. When, however, the 20-minute time limit is enforced very few are capable of completing the test. Thus for many the 30-minute test is a power test in which the major problem is not one of speed, but rather one of accuracy. With the shorter time limit the problem is one of working as rapidly as possible, and the examination becomes a speed test. High school students, being more test-sophisticated than most other groups, have long been accustomed to place a premium on speed, and are at the age when speed is the greatest. Consequently they tend to make higher scores with the shorter time limit than other less sophisticated subjects. Thus it results that a group such as the one in question may obtain spuriously high scores, merely as a function of the mechanics of the administration of the examination, and not as a function of the actual ability of the subjects involved. At the same time, the rank of a given individual in the group in question will probably be a valid indication of his intellectual standing within that group, making the shorter test useful for restricted survey testing and for research purposes, but not for individual guidance or comparisons with groups tested under a 30-minute time limit.

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NEWS AND NOTES

A California Association of Applied Psychologists was formed at a meeting held in Los Angeles on February 28, 1942. The general purposes of the Association are to develop the science and techniques of applied psychology, to extend the utilization of the facts, principles and procedures of scientific psychology, and to promote the services which applied psychology can render to the individual and to society. The professional practice of psychology is considered to be, in a general way, the application of the principles and techniques of the science of psychology to the measurement, evaluation, examination, interpretation, motivation, guidance, and redirection of human behavior.

There are two Branches of the new organization: one for Southern California and one for Northern California, which are to hold at least bi-monthly meetings. The whole Association meets twice a year. Information concerning the qualifications for membership, Fellow and Associate, may be had from any of the following officers: President, Herman de Fremery, Alto Psychologic Center, San Francisco; Vice-President, Guy W. Wadsworth, Southern California Gas Company, Los Angeles; or Secretary-Treasurer, Sybil K. Richardson, of the University Elementary School, Los Angeles.

Many readers of this Journal, especially those who are conducting Defense Training Courses, will be interested in learning that reprints of an article by Dr. Bruce V. Moore, Pennsylvania State College, entitled "Analysis of Results of Tests Administered to Men in Engineering Defense Training Courses" are available. This article appeared in the December 1941 issue of the Journal of Applied Psychology. Single copies are 20 cents each; six copies, $1.00; special rates on larger quantities. Orders may be sent to the Editor of the Journal, Ohio University, Athens, Ohio.

Dr. C. Charles Burlingame, head of the Neuro-Psychiatric Institute of Hartford, in the 118th annual report of that institution points out several distinct lines along which the medical specialist in psychiatry can render valuable service in the present war. First, would be the dual role in so-called psychological warfare: one as combat officers advising and assisting in the direction of offensives against the enemy, and the other, a defensive role against the psychological warfare being directed by the

enemy against our armed forces and civilian population. Second, would be the role of assisting the Selective Service Draft Boards through the elimination of the potentially unfit. Third, would be the function of detecting and eliminating from the armed forces those who show signs of being psychotic or having psychiatric problems. A fourth function would be that of actual therapeutic care rendered outside of the active combat forces.

Dr. Burlingame said that in no previous war have psychological components been as important as in the present conflict, and that factors such as "morale" have attained a value almost equal to that of guns and ships. "But while there seems to be a widespread recognition of the value of psychology in modern warfare, there seems to be less understanding of what these factors are, if we can judge by the present loose usage of terms such as 'psychological warfare,' 'morale,' 'psychological front,' 'fifth columnists' and 'sabotage.' . . . In the last analysis, morale is the state of mind of each individual and the morale of the group is the sum total of the states of mind of all the individuals within that group. There should be no mystery about this and we should see clearly and state with clarity that morale in warfare is based principally upon having something to fight for, understanding what that something is, and then having the necessary equipment with which to fight. . . . Real morale is neither built by slogans, catch phrases, song and dance acts on the stage, or even by attractive movie actresses making whirlwind visits through the army camps. This may be diversion but it is not morale nor does it build morale."

The Council on Human Relations is interested in furthering collaboration among all students of personality and culture whose collected materials, current researches, and projects of research may be useful for a scientific approach to problems of international relations. In particular, the Council is interested in the immediate problems of cooperation among the allied nations and the future problems of world reorganization, when the cooperation of all nations will be necessary.

The Council is requesting the following information:

1. Names of persons who are:
   a. Carrying on such researches.
   b. Have carried on such researches.
   c. Have raw materials or facilities for such researches.
2. Descriptions of bodies of collected materials which are relevant to the personality and culture problem, especially in the major contemporary cultures of the world, both occidental and oriental.
3. Information about all proposals for current cooperation and postwar planning which explicitly recognize that members of different

cultures have been reared under different sets of institutions, have different personality structures, and diverse ways of seeking social order.

4. Information about new techniques or new applications of existing techniques to the problem of cross-cultural differences in personality and character.

The Council hopes to serve as a clearing house for research in this broad field, by putting those who are interested in working on the same culture in touch with each other, and those who are working with comparable techniques, but on different cultures, in touch with each other. The Council also proposes to circulate among its collaborators abstracts and bibliographies on these subjects.

All communications should be addressed to Gregory Bateson, Council on Human Relations, 15 West 77th Street, New York City.

Dr. Forrest H. Kirkpatrick, of the R.C.A. Manufacturing Company of Indianapolis, Indiana, contributes the following note to our readers:

"The 1941 report of the National Institute of Industrial Psychology in London states that the British Admiralty and the War Office had called upon every member of the Institute's vocational guidance staff for some type of war service. The usual summer courses for 1941 were cancelled and severe restrictions put on the number of individual vocational and educational guidance consultations. Nevertheless, advice has been given during the year to 175 boys and 123 girls, making a total of 298. The report states:

While the use of the Institute's staff on the immense problem of selection and allocation for the Services should cause the greatest satisfaction, the problem of ensuring the continuation of the ordinary work of the Vocational Guidance Department has caused some anxiety. The position was further complicated by the receipt of over 400 requests for guidance following upon a broadcast reference to the Institute's work made by Dr. C. E. M. Joad and Dr. Julian Huxley.

Mr. Alec Rodger is now able, very occasionally, to undertake individual consultations. But chiefly upon Miss M. B. Stott, a member of the Department from 1925 until early in 1940, falls the task of dealing patiently with the several hundred young people on the Institute's waiting-list for vocational guidance consultations. With her invaluable assistance, it should be possible for this work of the Department to be continued in such a way that it may be quickly developed at the end of the war.

"The report also carries the following information as to their research program:

Tests of general intelligence, verbal ability and spatial judgments have been given to 400 elementary school children aged 10–11 and a group of 200 aged 13–14 consisting of elementary school children and a representative proportion from secondary schools. The purpose of the testing was to find out whether spatial judgment can be measured as effectively at 10–11 as at 13–14. This research, carried out by Mr. Slater, is based on

the assumption that spatial judgment is of critical importance for a successful technical school career, that verbal ability is essential for secondary school work and that general intelligence is important for careers of both types. The research thus bears both on the selection of secondary and technical school children and on the maturation of certain abilities.

Information from the United States Bureau of Census is now available only in selected libraries, according to one of a series of original articles about the Census which appeared in the February issue of the *Wilson Library Bulletin*. Because of paper scarcity the Bureau is supplying only selected libraries with current publications, many of which are vital to those planning for wartime operations and post-war adjustments. Frank R. Wilson, chief of the Bureau's division of information and publication, explained to *Wilson Library Bulletin* readers how their libraries could cooperate with this new war measure. Presenting a colorful picture of the United States, the series explained facts on wartime distribution of census publications; use of vital statistics by libraries; census services other than regular reports; census statistics for wartime operations; census of business; census of manufactures, 1939; facts about America's farms; mineral industries in the United States and significant facts about state and local government.

Dr. S. J. Beck, Head of the Psychology Laboratory, Michael Reese Hospital, Chicago, Illinois, will offer a summer course in The Rorschach Test in Personality Study and Clinical Diagnosis. The course includes the technique of administration of the Rorschach Test and scoring the responses, and their interpretation. The course will be in session in two two-hour periods daily from June 22–26, 1942.

BOOK REVIEWS

R. C. OLDFIELD, *The Psychology of the Interview.* London: Methuen. 1941. pp. xv + 144.

Here is a book from England based on data obtained by watching numerous skilled interviewers at work; by interviewing the interviewers about their methods; and by conducting interview experiments using certain special procedures. It discusses the best types of procedures; the attitudes to be adopted by the interviewer; and the manner in which he may formulate his judgments afterwards.

Oldfield states that the interview is not an interchange of stereotyped question and answer, followed by the formation of an equally stereotyped assessment in set terms of the nature of the candidate's personality or fitness for an occupation. It is essentially an interplay of attitudes between interviewer and applicant. Too much emphasis seems to be placed on the fact that the interviewer bases his judgment on the attitudes displayed by the candidate before him.

A considerable part of the discussion appears to consist of general observations which frequently have been made concerning the art and process of interviewing. Oldfield does not include a bibliography or any reference to the work of other students of the interview and one wonders whether he consciously or unconsciously ignored the fine research of several men in this country in the psychology of the interview.

Dr. C. S. Myers writes in the foreword that this book is a product of a research studentship under the National Institute of Industrial Psychology which the author held for fifteen months. This book will be interesting to vocational counselors but they may be somewhat disappointed in terms of vitality and validity.

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SWENSON, ESTHER J. *Retroactive Inhibition, A Review of the Literature.* The University of Minnesota Studies in Education, College of Education, Number One. The University of Minnesota Press. Minneapolis, 1941.

This little book of 59 pages, with a bibliography of 75 titles, is a splendid example of what is needed in a number of restricted areas in the field

of psychology. This volume summarizes the experimental work on retroactive inhibition since Britt's survey in 1935. This summary will be of interest in general psychology and also in educational psychology. It emphasizes the relationships of retroaction with learning, retention, and transfer.

The material in Chapter 2 is organized according to Britt's plan. The results on the degree of similarity between original and interpolated activities lead the author to agree that Robinson's theoretical curve is at least roughly accurate. The most effective temporal position of the interpolated activity is the extreme, either adjacent to the original learning or to the recall of original learning. Retroactive inhibition is correlated with the amount of interpolated activity; and is lessened with experience or practice. Since Nagge's work contradicts Mitchell's results, Britt may have concluded too soon that "there is less retroaction when both original and interpolated learning takes place in the same (waking or hypnotic) than when they occur in different states." Again the author questions Britt's conclusions on the effect of the nature of the learning material. A blanket statement that meaningful material is subject to retroactive inhibiion should not be made. Rather, "when meaningful relationships within each body of materials (interpolated or original) outweigh confusing relationships between the two sets of materials, the chances of retroaction are lessened."

Likewise, it is too early to conclude that there are no sex or age differences in susceptibility to retroaction; nor is there a reliable difference when the retroactive effect is measured by recall or relearning.

Of the three theories, perseveration, transfer, and transfer and disruption, the author favors the last two. Particularly pertinent is the hypothesis of McGeogh and McKinney that "degrees of organization may constitute a factor coordinate with similarity in an interpretation of the transfer theory."

What are some of the educational implications of the experimental findings on retroactive inhibition? (a) Children retain more if the method of learning emphasizes reasoning more than memorizing; this is particularly true in teaching arithmetic. (b) The higher the degree of learning of the original material, the less susceptible it will be to retroactive inhibition, *i.e.*, the more thorough the mastery of this week's spelling, the less next week's lesson interferes with retention. (c) The longer the list of words in the second week's lesson, the more chance there is for interference. But, if the second list is learned better than the previous list, the inhibitory effect is lessened. In brief, the amount of material and the degree of mastery should be controlled for maximum learning. (d) As to the amount of material in a "unit," organization plays a major role. Even large units of material which are organized in purpose or plan are less

susceptible to retroaction than smaller units with less organization. "We should so plan learning units as to include those related materials and concepts which belong together." Of course this does not mean that each unit should be considered in isolation, but as a part of a still larger unit (the course, for example).

Then the teacher asks: "Can I depend upon the class-room results following the trend of experimental results? and the answer is 'No.'" However, "It seems in general that the conditions contributing to the construction of well-organized patterns of knowledge and skill are those for which retroactive inhibition is at a minimum. Previous experience, meaningfulness of material, intelligence, and general maturity seem to result in such reduction of inhibitory effects. On the other hand, retroaction tends to increase under conditions contributing to disorganization or confusion of original and interpolated learning materials."

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MCKIM, MARGARET GRACE, PH.D. *The Reading of Verbal Material in Ninth Grade Algebra.* Teachers College, Columbia University Contributions to Education, No. 850. Bureau of Publications, Teachers College, Columbia University. New York, 1941.

"In a narrow sense, reading is often regarded as the ability to recognize printed words. . . . A much broader concept . . . conceives reading as a purposeful activity which may alter the outlook of the individual, deepen his understanding, aid in the reconstruction of experiences, stimulate intellectual and emotional growth, modify behavior and, in these various ways, promote development of rich and stable personalities. It recognizes also that reading is a highly complex activity including various important aspects, such as recognizing symbols quickly and accurately, apprehending clearly and with discrimination the meanings implied by the author, reacting to and using the ideas secured through reading in harmony with the reader's purposes, and integrating them into definite thought and action patterns." The present study takes this point of view.

"That each school subject not only requires certain general skills common to all reading but also has its own peculiar demands to make on the reader, is an inherent part of the broad concept of reading just discussed."

The author subscribes to Strang's suggestion that we need "a series of group scales which would measure a student's ability to read with comprehension typical passages in the various subject-matter areas." By not having such instruments we cannot explore "the relationships between the abilities needed to read different kinds of content, and the importance of the ability to read content of one subject to achievement in that subject."

The present study was undertaken with two purposes in view: 1. On the basis of an analysis of the reading demands made by typical material, to prepare tests of the comprehension of explanatory passages and problems in ninth grade algebra. 2. With these instruments and others selected to give additional information, to determine the intercorrelations among intelligence, ability to read non-algebraic material, ability to read algebraic material, and achievement in algebra.

The demands made on the reader by the subject matter of elementary algebra are thought to lie in five areas: 1. Vocabulary; 2. The reading of symbolism; 3. The reading of explanatory passages; 4. The reading of problems; 5. The reading of computations as they are being made. These areas are interrelated.

Two of these areas, reading explanatory passages and the reading of problems, are supposed to represent two of the main sources of verbal material in algebra, "and may thus be supposed to give the best general indication of the ability of the student to read and comprehend his textbook successfully by himself."

Since no existing tests suited exactly the author's purpose, she selected passages according to definite criteria for testing these abilities. Five passages were included in the test of reading explanatory passages. Questions designed to test ability to understand the development of the passage composed Section A; and in Section B were questions designed to test the student's grasp of the entire passage. Validity of Section A (each item correlated with the total score) yielded r's 0.12 to 0.68; and of Section B, r's 0.43 to 0.80. The reliability in averaged r's was for Section A, .41, and for Section B, .61.

The test for ability to read problems had parts A, B, and C. The reliability of Parts A plus B was .58, and for part C, .66. Validity was considerably lower.

The population of the experimental group was 120 pupils in the ninth grade, first term algebra; with mean IQ of 117.04, S.D. 14.03. In addition, the mean reading age on the New Stanford Test of Word Meaning was 16–5, and the mean on the New Stanford Test of Paragraph Meaning was 16–8; and the mean score on the Orleans Algebra Prognosis Test was 101.

Raw correlations and factor analysis yield evidence of a common underlying factor in all the tests, which is interpreted to be a function of general intellectual ability, and also elements specific to groups of tests. The reading tests all measure a common factor, or ability, yet each test measures a different combination of specific abilities. A fact which no doubt pleased the author is that her tests correlated a little better with the final examination scores in algebra than did any of the standardized tests. "Perhaps a prognosis test before experience with algebra is not

as good an indicator of algebra ability as a test of reading and understanding new material given after several months of study of algebra.'' The best single estimate of algebra achievement in the test battery is the Test of Reading Explanatory Passages, showing an r of .67 with a midterm and final examination.

An important educational implication from this study is that there is no general reading ability which assures equal facility in all kinds of materials. Therefore, it is the duty of the algebra teacher to teach reading skills in order to meet the different requirements of reading in that subject.

This book should be read carefully by all teachers of high school mathematics. The results of this study will find a place with experimental data on general and specific reading abilities.

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NEW BOOKS AND PAMPHLETS RECEIVED

Books and pamphlets for review should be sent to James P. Porter, Editor, JOURNAL OF APPLIED PSYCHOLOGY, Ohio University, Athens, Ohio.

About Ourselves. JAMES G. NEEDHAM. The Jaques Cattell Press, Lancaster, Pa., 1941. 276 pp.

Annual Report of the Carnegie Foundation for the Advancement of Teaching (1940–41). 522 Fifth Avenue, New York.

Clinical Application of the Rorschach Test. RUTH BOCHNER, FLORENCE HALPERN AND KARL M. BOWMAN. Grune & Stratton, New York, 1942. $3.00. 220 pp.

Development and Learning. WILLIAM F. BRUCE AND FRANK S. FREEMAN. Houghton Mifflin Company, 1942. 552 pp.

Educational Psychology. ARTHUR I. TAGES, ARTHUR T. JERSILD, T. R. MCCONNELL AND ROBERT C. CHALLMAN. Macmillan Company, New York, 1942. $3.00. 805 pp.

Environment and Education. ERNEST W. BURGESS, W. LLOYD WARNER, FRANZ ALEXANDER AND MARGARET MEAD. University of Chicago, Chicago, Ill., 1942. $1.00. 66 pp.

A Functional Pattern Technique for Classification of Jobs. EDWIN W. DAVIS. Bureau of Publications, Teachers College, New York, 1942. $1.60. 128 pp.

General Psychology. W. B. PILLSBURY AND L. A. PENNINGTON. The Dryden Press, New York, 1942. $1.35. 400 pp.

Guide Book for Boys. STEPHEN HABBE. National Training School for Boys. Department of Justice, Washington, D. C. 35 pp.

How to Improve Your Personality—With Teachers' Manual. ROY NEWTON. McGraw-Hill Book Company, New York, 1942. $1.75, Text; 25 cents, Manual. 201 pp.

Fields of Psychology—An Experimental Approach. ROBERT H. SEASHORE, Editor. Henry Holt & Company, New York, 1942. $3.25. 645 pp.

Philosophy and Order. Proceedings of The American Catholic Philosophical Association, Vol. XVII. Seventeenth Annual Meeting, December 29, 30, 1941. Catholic University of America, Washington, D. C. $2.00. 204 pp.

Psychology for Individual Education. Edited by ESTHER RAUSHENBUCH. Columbia University Press, New York, 1942. $2.75. 306 pp.

Psychology—The Science of Behavior. KARL F. MUENZINGER. Harper & Brothers, New York, 1942. $3.00. 441 pp.

Pupil Personnel Services as a Function of State Departments of Education. Bulletin 1940—No. 6, Monograph No. 5. DAVID SEGEL AND MARIS M. PROFFITT. Federal Security Agency, U. S. Office of Education, Washington, D. C. 84 pp.

Radio Audience "Ratings." MATTHEW N. CHAPPELL. C. E. Hooper, Inc., New York. 23 pp.

Radio in the Classroom—Report of the Wisconsin Research Project in School Broadcasting. University of Wisconsin Press, Madison, Wisconsin, 1942. $2.00. 203 pp.

The Rockefeller Foundation Review for 1941. RAYMOND B. FOSDICK, President. New York City. 64 pp.

The Rorschach Technique. BRUNO KLOEPFER AND DOUGLAS MCGLASHAN KELLEY. World Book Company, Yonkers, New York, 1942. 435 pp.

School for Social Work. Bulletin of Smith College, February, 1942, Northampton, Mass. 88 pp.

Studies on the Reliability of Tests. ROBERT W. B. JACKSON AND GEORGE A. FERGUSON. Department of Educational Research, University of Toronto, Toronto, Canada, Bulletin No. 2. $1.00. 122 pp.

A Summary of Manual and Mechanical Ability Tests (Preliminary Form). GEORGE K. BENNETT AND RUTH M. CRUIKSHANK. Psychological Corporation, 522 Fifth Avenue, New York, 1942. 75 pp.

Teaching of Biology in Secondary Schools of the United States. OSCAR RIDDLE, Editor, F. L. FITZPATRICK, H. B. GLASS, B. C. GRUENBERG, D. F. MILLER AND E. W. SINNOTT. Union of American Biological Societies, 1942. 76 pp.

Training for Speed and Accuracy of Visual Perception in Learning to Spell. LUTHER C. GILBERT AND DORIA WILCOX GILBERT. University of California Press. Berkeley, California, 1942. 75 pp.

Directory of American Psychological Periodicals

(Continued)

Journal of Comparative Psychology—Baltimore: The Williams & Wilkins Co. Subscription $7.00 per volume of 500 pages. Two volumes every year. Acting Managing Editor, Roy M. Dorcus. Founded 1921.

Comparative Psychology Monographs—Baltimore: Williams & Wilkins Co. Subscription $6.00. 400 pages per volume. Roy M. Dorcus, Managing Editor. Published without fixed dates, each number a single research. Founded 1922.

Genetic Psychology Monographs—Provincetown, Mass.: The Journal Press. Subscription $7.00 per volume. One volume per year. Edited by Carl Murchison and an international cooperating board. Quarterly. Each number one complete research. Child behavior, animal behavior and comparative psychology. Founded 1925.

Psychological Abstracts—Ohio State University, Columbus, Ohio: American Psychological Association. Subscription $7.00 a year ($7.25 foreign). 700 pages ann. Edited by W. S. Hunter. Monthly. Abstracts of psychological literature. Founded 1927.

Journal of Genetic Psychology—Provincetown, Mass.: The Journal Press. Subscription $14.00 per annum; $7.00 per volume. 1,000 pages annually (2 volumes). Edited by Carl Murchison and an international cooperating board. Quarterly. Child behavior, animal behavior, and comparative psychology. Founded 1891.

Journal of Social Psychology—Provincetown, Mass.: The Journal Press. Subscription $7.00. 500–600 pages annually. Edited by John Dewey, Carl Murchison, and an international cooperating board. Quarterly. Political, racial, and differential psychology. Founded 1929.

Personnel Journal—New York: The Personnel Research Federation. Subscription $5.00. 400 pages. Edited by Charles S. Slocombe. Published monthly, except July and August.

Mental Measurement Monographs—Baltimore: The Williams & Wilkins Company. Subscription $5.00. 400 pages annually. Edited by Knight Dunlap and Buford Johnson. Published without fixed dates, each number a single research. Founded 1925.

Studies in Psychology and Psychiatry—Baltimore: The Williams & Wilkins Company. Subscription $5.00. 400 pages annually. Edited by Edward A. Pace. Published without fixed dates, each number a single research. Founded 1926.

Journal of Educational Psychology—Baltimore, Md.: Warwick & York. Subscription $6.00. Edited by Jack W. Dunlap, Harold E. Jones, and Percival M. Symonds. Published monthly except June to August. Founded 1910.

Child Development—Baltimore, Md.: Williams & Wilkins Company. Subscription $5.00. 400 pages annually. Edited by Buford Johnson. Quarterly. Founded 1930.

Character and Personality—Durham, N. C.: Duke University Press. Subscription $2.00 per annum. Quarterly. Published simultaneously in Great Britain and the United States. Edited by Charles E. Spearman (London) and Karl Zener (Duke University). Founded 1932.

Journal of Psychology—Provincetown, Mass.: The Journal Press. Subscription $14.00 per annum; $7.00 per volume. 1000–1200 pages annually. Immediate publication for any accepted manuscript. Edited by Carl Murchison and an editorial board. Quarterly. The general field of psychology. Founded 1936.

Directory of American Psychological Periodicals

American Journal of Psychology—Ithaca, N. Y.: Cornell University. Subscription $6.50. 624 pages annually. Edited by E. M. Dellenbach, M. F. Washburn, M. Bentley, E. G. Boring. Quarterly. General and experimental psychology. Founded 1887.

Journal of General Psychology—Provincetown, Mass.: The Journal Press. Subscription $4.00 per annum; $7.00 per volume. 1600 pages annually (2 volumes). Edited by Carl Murchison and an international cooperating board. Quarterly. Experimental, theoretical, clinical, and historical psychology. Founded 1927.

Psychological Bulletin—Ohio State University, Columbus, Ohio: Psychological Review Company. Subscription $6.50 (Canada, $6.75). Single copies, $1.00. 540 pages annually. Bi-monthly. Critical contributions only. Edited by Herbert S. Langfeld. Founded 1904.

Psychological Monographs—Ohio State University, Columbus, Ohio: Psychological Review Company. Subscription $6.00 per vol. 500 pages. Edited by John F. Dashiell. Published irregularly, each issue one or more researches. Founded 1895.

Psychological Bulletin—Ohio State University, Columbus, Ohio: Psychological Review Company. Subscription $6.00. 720 pages annually. Psychological literature. Monthly, (10 numbers). Edited by John A. McGeoch. Founded 1904.

Archives of Psychology—New York: Columbia University. Subscription $3.00. 500 pp. ann. Ed. by R. S. Woodworth. Published without fixed dates, each number a single experimental study. Founded 1906.

Journal of Abnormal and Social Psychology—Ohio State University, Columbus, Ohio: American Psychological Association. Subscription $5.00. Foreign, $5.50. Editor, Gordon W. Allport. Quarterly. 360 pages annually. Abnormal and social. Founded 1906.

Psychological Monographs: General and Applied—Psychological Clinic Press. Subscription $6.00. 500 pages. Ed. by Lightner Witmer. Published fixed dates (Quarterly). Orthogenics, psychology, hygiene. Founded 1907.

Psychoanalytic Review—Washington, D. C.: 3617 13th St. N.W. Subscription $5.00. 500 pages annually. Psychoanalysis. Quarterly. Ed. by W. A. White and S. E. Jelliffe. Founded 1913.

Journal of Experimental Psychology—Ohio State University, Columbus, Ohio. Bimonthly; two volumes per year, each volume of six numbers containing about 600 pages. Experimental. Subscription $14.00 ($7.00 per volume). Edited by H. W. Pershinger. Founded 1916.

Journal of Applied Psychology—Lancaster, Pa.: Science Press Printing Co. Subscription $4.00. 400 pages annually. Bimonthly. Edited by James P. Porter, Ohio University, Athens, Ohio. Founded 1917.

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